Universidade de Aveiro Departamento de Biologia
Ano 2017

Lara Torres Conde

Diversidade de plasmídeos no ambiente e desenvolvimento de ferramentas moleculares para a sua caracterização

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Microbiologia, realizada sob a orientação científica da Doutora Cláudia Sofia Soares de Oliveira, Professora Auxiliar Convidada do Departamento de Biologia da Universidade de Aveiro

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palavras-chave Plasmídeos, IncP-1ε, *primers*, região acessória, ambientes

resumo

Os plasmídeos pertencentes ao grupo de incompatibilidade IncP-1ε, são um grupo bem estudado e com grande interesse ecológico. Tal é devido a estarem associados a genes acessórios que conferem aos hospedeiros bacterianos, adaptabilidade a pressões ambientais. A incompatibilidade é a manifestação de parentesco dos plasmídeos que partilham o mesmo modo de replicação. Os genes acessórios são genes não essenciais á manutenção e replicação do plasmídeo e encontram-se na região acessória. As regiões de genes acessórios de plasmídeos deste grupo de incompatibilidade apresentam um padrão típico de inserção no *backbone* do plasmídeo. Nomeadamente entre os genes *traC* e *parA* e os genes *trfA* e *klcA*, que flanqueiam os genes acessórios. Este trabalho teve como um dos objetivos desenvolver e otimizar uma ferramenta que possa ser aplicada em DNA plasmídico proveniente de uma amostra ambiental, para analisar as regiões variáveis em plasmídeos e procurar novos genes ou seguir o curso dos genes deste grupo de plasmídeos. A região variável é a região acessória, onde se encontram os genes acessórios. Esta região é delimitada por genes flanqueadores.
Com este estudo foi possível verificar que os *primers* (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e *D/EklcA_rev*) desenhados amplificam a região acessória dos plasmídeos do subgrupo de incompatibilidade IncP-1ε.
A diversidade e evolução de plasmídeos depende intimamente das condições ambientais do hospedeiro bacteriano. As pressões seletivas sentidas contribuem para o fluxo de genes e a sua diversidade. Considerando a importância dos detalhes ecológicos, um dos objetivos deste trabalho foi o de procurar completar a informação dispersa e muitas vezes ausente na base de dados do NCBI. Esta informação inclui detalhes sobre o ano de isolamento, o local de isolamento (país e cidade) e o ambiente de isolamento original.
Com este estudo foi possível concluir que das 4 302 sequências de plasmídeos analisadas, os ambientes mais estudados são o clínico, os alimentos e os solos. *Proteobacteria, Firmicutes* e *Spirochaetes*, foram os filos mais estudados. A partir das 210 sequências analisadas de plasmídeos cujos hospedeiros bacterianos se encontram em ambientes extremos, foi possível concluir que os ambientes extremos mais estudados se encontram no solo e em água (doce e salgada), estes foram assim destacados devido a parâmetros ambientais, como o pH, a temperatura, a radiação e extremos químicos. *Proteobacteria, Deinococcus-Thermus* e *Firmicutes*, foram os filos mais encontrados em ambientes extremos.

keywords Plasmids, IncP-1ε, primers, accessory region, sources

abstract

The plasmids belonging to the IncP-1 incompatibility group are a well studied group with great ecological interest. This is because they are associated with accessory genes that confer on bacterial hosts adaptability to environmental pressures. Incompatibility is the manifestation of kinship of plasmids sharing the same mode of replication. Accessory genes are non-essential genes for plasmid maintenance and replication and are found in the accessory region. Regions of accessory genes of plasmids of this incompatibility group show a typical pattern of insertion into the plasmid backbone. Namely between the *traC* and *parA* genes and the *trfA* and *klcA* genes, which flank the accessory genes. This work had as one of the objectives to develop and optimize a tool that can be applied in plasmid DNA from an environmental sample, to analyze the variable regions in plasmids and to search for new genes or to follow the course of the genes of this group of plasmids. The variable region is the accessory region, where accessory genes are found. This region is delimited by flanking genes.

With this study it was possible to verify that the primers (*EtraC_fw* and *EparA_rev*) and (*EtrfA_fw* and *D/EklcA_rev*) amplified the accessory region of the plasmids of the subgroup of incompatibility IncP-1ε.

The diversity and evolution of plasmids closely depends on the environmental conditions of the bacterial host. The selective pressures felt contribute to the flow of genes and their diversity. Considering the importance of the ecological details, one of the objectives of this work was to seek to complete the scattered and often absent information in the NCBI database. This information includes details about the year of isolation, the place of isolation (country and city), and the original isolation environment.

With this study it was possible to conclude that of the 4 302 sequences of plasmids analyzed, the most studied environments are the clinical, the food and the soils. *Proteobacteria, Firmicutes* and *Spirochaetes*, were the most studied phyla. From the 210 analyzed sequences of plasmids whose bacterial hosts are found in extreme environments, it was possible to conclude that the most studied extreme environments are in the soil and in water (fresh and salty), these were thus highlighted due to environmental parameters, such as pH, temperature, radiation and chemical extremes. *Proteobacteria, Deinococcus-Thermus* and *Firmicutes* were the most common phyla in extreme environments.

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1. Introdução

1.1 Plasmídeos: Propriedades gerais

Os plasmídeos são porções de DNA extra-cromossomal circular ou linear que se replicam autonomamente na célula hospedeira. Em bactérias hospedeiras, parecem aumentar a sua diversidade genética ao adquirir genes e podem ser trocados horizontalmente entre populações bacterianas por conjugação ou mobilização. Em particular, plasmídeos com uma larga gama de hospedeiros oferecem maleabilidade genética à comunidade bacteriana, permitindo interconexões entre espécies, géneros e famílias. Um plasmídeo com largo espectro de hospedeiros é capaz de se replicar e ser mantido estável em pelo menos duas classes bacterianas diferentes sem seleção. Enquanto, um plasmídeo com estreito espectro de hospedeiros se encontra sempre na mesma classe, género ou espécies bacterianas (Frost et al., 2005; Thomas & Nielsen, 2005).

A transferência horizontal de genes (HGT) é a transferência de informação genética entre bactérias dadoras e recetoras. A HGT pode ocorrer através de diferentes processos como a transformação, a transdução ou a conjugação. A transferência horizontal de genes contribui para a diversidade e adaptação microbianas. A conjugação, mediada por plasmídeos tem um papel fundamental na HGT. Normalmente, possuem genes que codificam produtos envolvidos na desintoxicação ambiental, virulência, interações ecológicas do hospedeiro e resistências a antibióticos. Os plasmídeos atuam como "veículos" de patogenicidade e traços ambientalmente importantes. A HGT por conjugação é considerada uma estratégia genética usada por bactérias para aumentar a sua adaptação a ambientes em rápida mudança. Assim, a transferência conjugativa dos plasmídeos é um dos mecanismos mais importantes para a promoção da adaptação e evolução das bactérias (Smillie et al., 2010; Thomas & Nielsen, 2005).

A estrutura comum dos plasmídeos contém: uma região denominada de *backbone*, que contém os genes essenciais à manutenção e replicação do plasmídeo e a região acessória que contém os genes acessórios, não essenciais, podendo esta encontrar-se vazia. Análises ao *backbone* revelaram genes para a replicação, manutenção e transferência. A análise genómica comparativa verificou que parece haver zonas preferenciais onde as regiões de genes acessórios se inserem, *hotspots,* onde cassetes de genes são introduzidas e mobilizadas por ação de integrases e transposases. A associação de plasmídeos com outros elementos genéticos móveis como

integrões e transposões promove ainda mais a troca e recombinação de genes. Os integrões capturam cassetes de genes que não possuam promotores, num local de ligação a jusante de um promotor por ação de sua integrase. Podem também levar cassetes de genes para outros integrões ou locais secundários. Os transposões são elementos genéticos que se podem mover dentro ou entre replicões por ação de sua transposase (Heuer & Smalla, 2012; Oliveira et al., 2013).

O conjunto de genes de mobilidade (MOB) encontra-se em todos os plasmídeos (figura 1), é fundamental e permite a transmissão de DNA do plasmídeo entre uma célula bacteriana dadora e outra recetora. Outros genes envolvidos na mobilidade são os de *mating pair formation* (MPF) associados unicamente a plasmídeos conjugativos, estes iniciam um processo associado à membrana do hospedeiro bacteriano (figura 1). São uma forma de um sistema de secreção tipo 4 (T4SS) e fornecem o canal de acoplamento, para a transmissão de genes (Smillie et al., 2010).

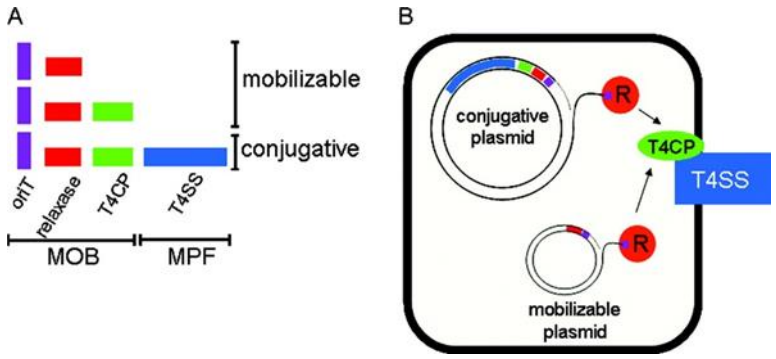


Figura 1 – Esquema representativo dos genes (MOB e MPF) implicados na mobilidade de plasmídeos entre hospedeiros bacterianos (Smillie et al., 2010).

De acordo com a presença ou ausência destes elementos, os plasmídeos podem ser classificados de acordo com a sua mobilidade em conjugativos, mobilizáveis ou não-mobilizáveis. Um plasmídeo que possua genes MPF, além de genes MOB, é denominado conjugativo, se não os possuir é denominado mobilizável. A mobilização é outro processo de transferência de plasmídeos que difere da conjugação no conjunto de genes necessários ao mesmo. Assim, os plasmídeos envolvidos neste processo apenas necessitam do conjunto de genes MOB. Os plasmídeos são transmitidos entre células através de processos como, por exemplo, a conjugação ou a mobilização direta (figura 2) (Smillie et al., 2010).

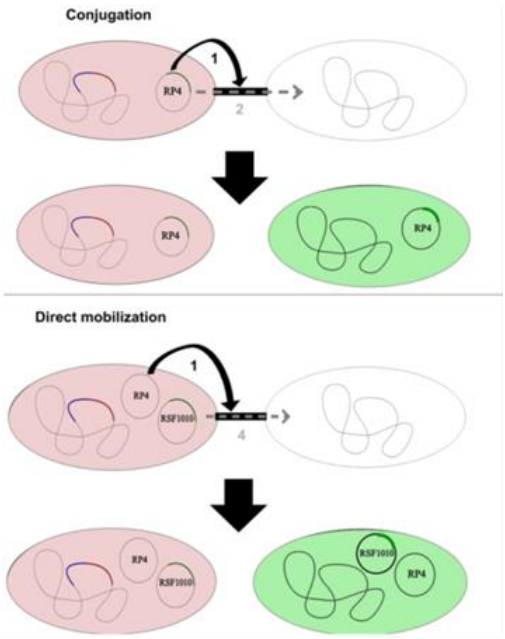


Figura 2 – Esquema representativo de diferentes tipos de mobilidade de plasmídeos entre hospedeiros bacterianos. 1- Formação do canal de acoplamento, um *pilus*, que permite a passagem do plasmídeo da célula dadora para a célula recetora. Na conjugação o *pilus* é formado com ajuda dos genes MPF presentes no plasmídeo encontrado na célula dadora. Na mobilização é formado com a ajuda dos genes MPF presentes no plasmídeo conjugativo encontrado na célula dadora, uma vez que o plasmídeo mobilizável não os possui. 2- Passagem do plasmídeo conjugativo da célula dadora para a célula recetora. 4-Passagem dos plasmídeos conjugativo e mobilizável da célula dadora para a célula recetora (Klümper et al., 2014).

Os genes acessórios dos plasmídeos que existem na região acessória podem conferir resistências a antibióticos ou metais, ou ainda levar à produção de enzimas envolvidas na degradação de compostos xenobióticos, entre outras resistências e aptidões ao meio em que se insere o hospedeiro bacteriano. No entanto, também existem plasmídeos sem genes acessórios, podendo assim esta região encontrar-se vazia (Dennis, 2005; Heuer & Smalla, 2012).

1.1.1. Grupos de incompatibilidade nos plasmídeos

Em 1971, Hedges e Datta propuseram um esquema de classificação de plasmídeos baseado na estabilidade dos plasmídeos durante a conjugação, a incompatibilidade dos plasmídeos. Esta é a manifestação do parentesco dos plasmídeos que partilham o mesmo modo de replicação. Um esquema formal da classificação de plasmídeos é baseado em grupos de incompatibilidade (Inc). Um procedimento para o agrupamento em incompatibilidades é baseado na introdução, por

conjugação ou transformação, de um plasmídeo de um grupo de incompatibilidade desconhecido numa bactéria contendo um plasmídeo de um grupo de incompatibilidade conhecido. A classificação de plasmídeos em grupos de incompatibilidade é possível tanto para plasmídeos conjugativos como para os não-conjugativos. Se o plasmídeo residente no hospedeiro bacteriano é eliminado na progenia, o plasmídeo introduzido é classificado como sendo do mesmo grupo de incompatibilidade do primeiro. Plasmídeos com o mesmo modo de replicação são incompatíveis, enquanto plasmídeos com diferentes modos de replicação são compatíveis. Dois plasmídeos pertencentes ao mesmo grupo de incompatibilidade não podem ser propagados na mesma linha celular (Couturier et al., 1988; Novick, 1987).

Atualmente, 27 grupos de incompatibilidade são reconhecidos na família *Enterobacteriaceae* pela *Plasmid Section of the National Collection of Type Cultures* (Londres, Reino Unido) (Carattoli, 2009).

Genes que codificam para processos degradativos completos ou parciais foram previamente localizados em plasmídeos pertencendo aos grupos de incompatibilidade IncP-1, IncP-7 e IncP-9. Estes normalmente possuem genes responsáveis pela degradação de compostos xenobióticos e poluentes orgânicos naturais, sendo essenciais na adaptação de comunidades bacterianas a compostos tóxicos no seu ambiente (Dealtry et al., 2014; Heuer & Smalla, 2012).
A capacidade para reconhecer e categorizar plasmídeos em grupos homogéneos com base na sua filogenia ajuda a analisar a sua distribuição na natureza e a sua relação com as células hospedeiras e a descobrir as suas origens evolutivas. A identificação de plasmídeos em grupos de incompatibilidade também tem sido importante para seguir a disseminação de plasmídeos que conferem resistência a antibióticos, para epidemiologia de plasmídeos emergentes em ambientes relacionados com a clínica (Francia et al., 2004).

1.1.2. História dos plasmídeos IncP-1

Os plasmídeos pertencentes ao grupo de incompatibilidade IncP-1, possuem largo espectro de hospedeiros bacterianos e diversidade de fenótipos associados aos genes acessórios que possuem, por isso têm recebido muita atenção nos últimos anos. Os primeiros plasmídeos do grupo de incompatibilidade IncP-1 a serem relatados foram isolados de hospedeiros bacterianos com alta importância clínica, sendo por isso, originalmente categorizados como clínicos. No

entanto, atualmente, este grupo é considerado ubíquo e vários estudos usando métodos independentes do cultivo isolaram estes plasmídeos de solos e outros ecossistemas, tais como, esgotos e estrume (Heuer & Smalla, 2012).

Foram analisados genes completos do *backbone* de plasmídeos do grupo de incompatibilidade IncP-1, demonstrando assim a existência de sete subgrupos e a importância da recombinação homóloga na evolução destes plasmídeos. Os subgrupos foram definidos a partir do gene *trfA*, existente no backbone dos plasmídeos pertencentes ao grupo de incompatibilidade IncP-1. Durante os anos 90, a completa sequenciação de plasmídeos dos subgrupos IncP-1α e IncP-1β, providenciaram as primeiras comparações genómicas. A comparação das sequências confirmou a preservação das sequências de genes essenciais para a replicação e transferência entre os dois subgrupos. O *backbone* de ambos os subgrupos de plasmídeos mostrou ser tipicamente entrecortado com genes acessórios em duas regiões, que podem ser considerados *hotspots* de introdução de genes acessórios, entre os genes *trfA* e *oriV* e entre os operões *tra* e *trb* (Bahl et al., 2009; Heuer & Smalla, 2012).

Os subgrupos α e β foram os primeiros subgrupos a serem reconhecidos, através de dados de hibridização e de diferenças funcionais. Os subgrupos ϒ e δ, foram só mais tarde definidos através de análises filogenéticas a genes do seu *backbone* (Bahl et al., 2009).

Pensa-se que cada subgrupo foi formado como resultado de associações bem-sucedidas entre antigos *backbones* e genes acessórios vantajosos, ou ainda associação com um hospedeiro ou grupo de hospedeiros. A recombinação homóloga contribuiu para a evolução do *backbone* dos plasmídeos IncP-1. Além disso, estes têm evoluído e adaptado a diferentes espécies bacterianas hospedeiras (Bahl et al., 2009; Norberg et al., 2011).

A sequenciação destes plasmídeos revelou que existem mais subgrupos do que antes se pensara. Vários plasmídeos isolados exogenamente de solos foram associados a novos subgrupos, tais como, IncP-1ϒ, IncP-1δ e IncP-1ε (Heuer & Smalla, 2012).

1.1.2.1. Diversidade dos subgrupos de plasmídeos IncP-1

Os plasmídeos do grupo de incompatibilidade IncP-1 podem ser divididos em vários subgrupos. Deste modo, doze subgrupos foram atualmente propostos, sendo: α, β-1, β-2, ϒ, δ, ε, ς, κ, η, Θ e dois subgrupos ainda por nomear (Norberg et al., 2011; Norberg, Bergstrom & Hermansson, 2014).

A topologia espraiada da análise filogenética dos plasmídeos dos subgrupos do grupo de incompatibilidade IncP-1, visível na figura 3, é comum quando ocorre vasta recombinação, crescimento exponencial da população ou em que membros de cada subgrupo evoluíram em populações distintas. Esta árvore filogenética foi construída com base nos genes *traC*-*traM* dos plasmídeos analisados. É bastante provável que o *backbone* dos plasmídeos IncP-1 tenha evoluído em diferentes populações bacterianas, o que explica a diversidade dentro deste grupo de largo espectro de hospedeiros e a sua árvore filogenética alastrada (Norberg et al., 2011; Norberg, Bergstrom & Hermansson, 2014).

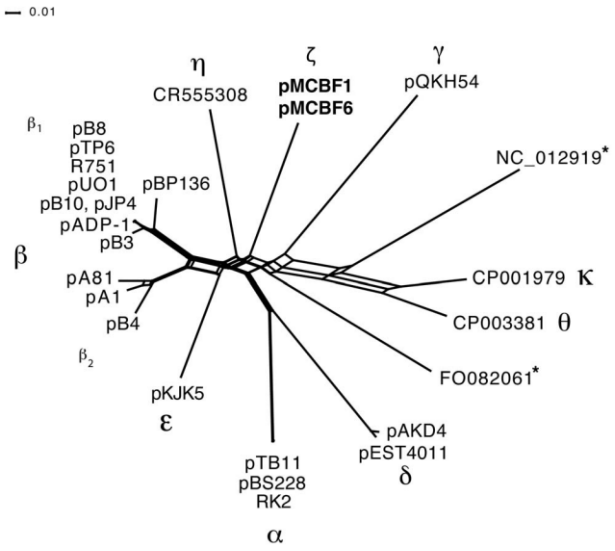


Figura 3 - Árvore filogenética representando os doze subgrupos pertencentes ao grupo de incompatibilidade de plasmídeos IncP-1. A árvore foi baseada no segmento genético contendo os genes *traC* - *traM* para todos os plasmídeos analisados (Norberg, Bergstrom & Hermansson, 2014).

1.1.2.2. Diversidade de *habitats* de hospedeiros de plasmídeos IncP-1

Os plasmídeos IncP-1 têm sido isolados de comunidades bacterianas de diversos ecossistemas (Tabela 1), tais como, esponjas marinhas, solos, sedimentos de rios, sedimentos marinhos, estações de produção de biogás e sistemas de biopurificação contaminados com pesticidas, estações de tratamento de águas residuais, patógenos de humanos e de peixes e recentemente, em biofilmes marinhos. Foram isolados plasmídeos de amostras de massas de água marinha, biofilmes e da microcamada de superfície (Bahl et al., 2007; Schlüter et al., 2007).
Além de plasmídeos isolados de comunidades bacterianas presentes em amostras de ambientes marinhos, também foram isolados plasmídeos pertencentes ao subgrupo InP-1ε de comunidades bacterianas presentes em amostras da interface ar-água do estuário de Aveiro, em Portugal (Norberg, Bergstrom & Hermansson, 2014; Oliveira et al., 2012).

Asseverou-se que as águas residuais constituem um reservatório para plasmídeos IncP-1 que possuem genes de resistência a antibióticos, através da confirmação da presença de cinco subgrupos de plasmídeos IncP-1 no mesmo local. Estes plasmídeos e toda a diversidade de genes *trfA* foram encontrados numa única amostra de águas residuais. A presença de todos os subgrupos no mesmo ambiente proporciona a recombinação entre estes, podendo originar novas combinações. Para além de ocorrer isolamento destes plasmídeos em águas residuais, também ocorrem isolamentos dos subgrupos α e β em lamas ativadas e pocilgas (Bahl et al., 2009; Binh et al., 2008). Foi também observada forte presença dos diferentes subgrupos de plasmídeos IncP-1 em amostras de sistemas de biopurificação (BPS) contaminadas com pesticidas. Assim, o uso de BPS é definido como uma forma de controlo da poluição usando microrganismos para degradar pesticidas, através de processos biodegradativos (Omirou et al., 2012).

A maioria dos plasmídeos IncP-1 tem sido isolada de acordo com as características fenotípicas exercidas sobre o seu hospedeiro bacteriano. É então provável que muitos plasmídeos estejam ainda por descobrir, podendo ainda encontrar-se plasmídeos dentro dos subgrupos já estabelecidos ou não.

Tabela 1 – Exemplos de plasmídeos pertencentes a cada subgrupo do grupo de incompatibilidade IncP-1 e respetivos ambientes em que se encontram.

Código de acesso Plasmídeo	**Subgrupo**	**Hospedeiro bacteriano**	**Origem do plasmídeo**	**Referência**
AJ744860.1 pTB11	α	N.I.	Lodo (Alemanha)	Tennstedt et al., 2005
AJ431260.1 pB4	β-1	N.I.	Lodo (Alemanha)	Tauch et al., 2003
AJ863570.1 pB8	β-2	N.I.	Lodo (Alemanha)	Schlüter et al., 2005
AM157767.1 QKH54	ϒ	N.I.	Rio (Reino Unido)	Haines et al., 2006
GQ983559.1 pAKD4	δ	N.I.	Solo (USA)	Sen et al., 2010
AM261282.1 pKJK5	ε	N.I.	Solo (Dinamarca)	Bahl et al., 2007
AY950444.1 pMCBF1	ς	N.I.	Biofilme marinho (Suécia)	Norberg et al., 2011
CP001979.1 pHP-42	κ	*Marinobacter adhaerens HP15*	Águas marinhas (Alemanha)	Gardes et al., 2010
CR555308.1 2	η	*Aromatoleum aromaticum EbN1*	Solo (Alemanha)	Rabus et al., 2005
CP003381.1 "unnamed"	θ	*Methylophaga frappieri JAM7*	Águas marinhas (Canadá)	Villeneuve et al., 2012
FO082061.1 MEALZ_p	*	*Methylomicrobium alcaliphilum 20Z*	Ambientes salinos (USA)	Vuilleumier et al., 2012
NC_012919.1 pP9014	*	*Photobacterium damselae subsp. Piscicida P9014*	Patógeno de peixes marinhos (Japão)	Castillo et al., 2013

N.I. – Não identificado

* - subgrupos sem nome

1.2. Evolução de bases de dados contendo sequências de plasmídeos

A "Plasmid Genome Database" (PGD) foi a primeira coleção de plasmídeos completamente sequenciados. Foi criada em 2003 estando disponíveis nessa altura cerca de 500 sequências completas de plasmídeos. Esta base de dados reuniu todos os plasmídeos completamente sequenciados, incluindo as suas características principais, a sua composição genética e mapas estruturais. Atualmente, esta base de dados já não se encontra em funcionamento (Mølbak,et al., 2003).

"GenBank"™ é uma base de dados pública que contém todas as sequências conhecidas de nucleótidos, incluindo informações biológicas e bibliográficas de suporte. Tem sido da responsabilidade do "National Center for Biotechnology Information" (NCBI) desde outubro de 1992. Em 1993, o "GenBank" continha mais de 111 000 sequências diferentes de nucleótidos. As entradas incluíam uma descrição da sequência de DNA, nome científico e taxonomia do organismo hospedeiro, uma tabela de características que especificam as regiões codificantes e outros locais de importância biológica. Os dados no "GenBank" resultavam inicialmente de anotadores que extraíam as informações de revistas relevantes e autores que enviavam os dados diretamente para a base de dados (Benson, Lipman & Ostell, 1993).

Em 2009 existiam 1 730 sequências completas de plasmídeos na base de dados "GenBank". O conjunto de plasmídeos analisados provinha de projetos de sequenciação de plasmídeos (62%) e de projetos de estudos de genomas microbianos (38%). O cultivo excessivo de hospedeiros bacterianos pode levar à perda de plasmídeos, o que leva a uma representatividade enviesada dos plasmídeos na base de dados. Do mesmo modo, a falta de representatividade na base de dados de plasmídeos provenientes de bactérias não-cultiváveis pode também levar a uma subamostragem de plasmídeos (Smillie et al., 2010).

Com a revolução da tecnologia de sequenciação, novas sequências de plasmídeos têm sido reportadas. Cerca de 4 602 sequências de plasmídeos completas encontravam-se em 2015 no "GenBank", das quais 4 418 foram isoladas de bactérias. Variações na percentagem (%) de conteúdo em GC (guanina e citosina) e no tamanho foram observadas entre os 4 602 plasmídeos encontrados na base de dados. O tamanho médio foi de 80kb e o conteúdo em GC médio foi de 44.1%. A maioria dos plasmídeos sequenciados foram encontrados em bactérias nos filos

Proteobacteria, Firmicutes, Spirochaetes, Actinobacteria e Cyanobacteria (Shintani, Sanchez e Kimbara, 2015; Smillie et al., 2010).

A distribuição bimodal do tamanho dos plasmídeos possui picos entre aproximadamente 4-8kb e 32kb, enquanto o número de plasmídeos sequenciados aumentou de 1 730 em 2009 para 4 602 em 2015. Este facto indica que a distribuição do tamanho dos plasmídeos é conservada, mesmo que o número de plasmídeos aumente (Shintani, Sanchez e Kimbara, 2015).

Os plasmídeos sequenciados na base de dados apresentam variabilidade em termos de filogenia, tamanho, conteúdo em GC e tipo (linear ou circular). Esta informação está bem organizada e apresentada na base de dados. No entanto nem toda a informação essencial está disponível, sobretudo a relativa aos detalhes ecológicos, como a descrição do ambiente de origem do hospedeiro, o ano de recolha e a geografia. De fato, das 4 315 sequências de referência (RefSeq) completas de plasmídeos da base de dados, em Janeiro de 2017, 83,5% não apresentam informação sobre a data, 57,3% sobre a localização geográfica e 45,7% não têm o ambiente de origem assinalado. O acesso a esta informação para a coleção de plasmídeos sequenciada tem interesse sobre o ponto de vista da ecologia, evolução de plasmídeos e epidemiologia.

2. Objetivos

Os plasmídeos pertencentes ao grupo de incompatibilidade IncP-1Ɛ, são um grupo bem estudado e com grande interesse ecológico, tal é devido a estarem associados a genes acessórios que conferem aos hospedeiros bacterianos adaptabilidade a pressões ambientais, como contaminação com antibióticos ou metais. As regiões de genes acessórios de plasmídeos deste grupo de incompatibilidade apresentam um padrão típico de inserção no *backbone* do replicão. Nomeadamente entre os genes *traC* e *parA* e os genes *trfA* e *klcA*, que flanqueiam os genes acessórios. Adicionalmente, verifica-se uma alta variabilidade das regiões acessórias já analisadas em plasmídeos pertencente ao grupo de incompatibilidade IncP-1Ɛ e que parece estar dependente tanto das condições ambientais como de pressões seletivas.

Este trabalho tem como um dos objetivos desenvolver e otimizar uma ferramenta que possa ser aplicada em DNA plasmídico ou proveniente de uma amostra ambiental, para analisar as regiões variáveis em plasmídeos e procurar novos genes ou seguir o fluxo de genes deste grupo de plasmídeos relacionados.

A estratégia utilizada para atingir este objetivo foi amplificar por PCR (Reação em Cadeia da Polimerase) regiões de genes acessórios de plasmídeos pertencentes ao grupo de incompatibilidade IncP-1Ɛ, a partir dos genes flanqueadores do *backbone.* Os genes acessórios variam de plasmídeo para plasmídeo, mas os genes flanqueadores são conservados entre os plasmídeos dos diferentes subgrupos.

A metodologia utilizada foi a descrita a seguir:

- Realizar o alinhamento de genes entre os plasmídeos do subgrupo IncP-1Ɛ;
- Desenhar *primers* que possam abranger os genes alvo para o subgrupo em estudo;
- Selecionar plasmídeos representativos e validar os *primers* através da amplificação das regiões acessórias entre os genes conservados do *backbone*;

A diversidade e evolução de plasmídeos depende intimamente das condições ambientais do hospedeiro bacteriano. As pressões seletivas sentidas contribuem para o fluxo de genes e a sua diversidade.

Considerando a importância dos detalhes ecológicos, um dos objetivos deste trabalho foi o de procurar completar a informação dispersa e muitas vezes ausente na base de dados de sequências completas de plasmídeos do NCBI. Esta informação inclui detalhes sobre o ano de isolamento, o local de isolamento (pais e cidade) e o ambiente de isolamento original.

A estratégia utilizada para atingir este objetivo foi retirar e organizar a informação disponível no *website* do NCBI numa tabela contendo as sequências dos plasmídeos. A informação foi organizada em geografia, data e origem. A geografia aponta-nos o país/cidade onde os plasmídeos foram descobertos. A data indica-nos o ano em que foram isolados e caracterizados. A origem indica-nos o ambiente em que os hospedeiros bacterianos foram originalmente descritos.

3. Materiais e Métodos

3.1. Estirpes bacterianas e plasmídeos utilizados neste estudo

Os plasmídeos pertencentes ao subgrupo de incompatibilidade IncP-1ε utilizados neste estudo estão descritos na tabela 2, com as suas características sumariadas.

Tabela 2 – Características gerais dos plasmídeos pertencentes ao subgrupo de incompatibilidade IncP-1ε.

Código de acesso Plasmídeo	**AM261282.1** pKJK5	**KC964607** pMLUA4	**KC964606** pMLUA3	**KC964605** pMLUA1	
Referência	Bahl et al., 2007	Oliveira et al., 2013	Oliveira et al., 2013	Oliveira et al., 2013	
Hospedeiro bacteriano	*Escherichia coli CSH26*	*Escherichia coli DH5alfa*	*Escherichia coli DH5alfa*	*Escherichia coli DH5alfa*	
Marcador de resistência	TET	TET	TET	TET	
Origem do plasmídeo	Solo (Dinamarca)	Água estuarina (Portugal)	Água estuarina (Portugal)	Água estuarina (Portugal)	
Tamanho (bp)	54383	55475	57859	58845	
GC (%)	61	60	60	60	
Genes flanqueadores	*parA-traC* *klcB-trfA*	*parA-traC* *klcB-trfA*	*parA-traC* *klcB-trfA*	*parA-traC* *klcB-trfA*	
Genes	*ISPa17, intI1, dfrA, aadA11b, qacEdelta1, sul1, IS1326, ist(B, A), tet(R, A)* -	*ISPa17, In794, intI1delta, IS26, tnpA, msr(E), mph(E), qacF5, qacEdelta1, sul1, tet(R, A), tniA* -	*ISPa17, In795, intI1delta, IS26, tnpA, msr(E), mph(E), qacF5, aadA4, qacEdelta1, sul1, tet(R, A), tniA* -	*ISPa17, In795, intI1delta, IS26, tnpA, msr(E), mph(E), qacF5, aadA5, qacEdelta1, sul1, IS1326, ist(B, A), tet(R, A), tniA* -	**Região acessória**
Tamanho (bp)	**(*parA-traC*)** 14097 **(*klcB-trfA*)** 1316	15190 1316	17574 1316	18560 1316	
Início/Fim	19421:33517 54383:1315	19420:34609 55475:1315	19420:36993 57859:1315	19420:37979 58845:1315	

3.1.1. Condições de crescimento e extração de DNA plasmídico

As estirpes bacterianas hospedeiras dos plasmídeos em estudo encontravam-se armazenadas no frio (-80ºC) em glicerol. Quando necessário, foi retirada uma alíquota para 8 ml de meio de cultura líquido LB (Luria-Bertani) e colocada a crescer durante a noite, a 30ºC, com agitação a 180 rpm (rotações por minuto). Por vezes foi necessária a adição do antibiótico tetraciclina (TET) a uma concentração de 50 µg/ml, preparado em metanol, de forma a garantir a presença do plasmídeo, uma vez que os plasmídeos em estudo conferem ao seu hospedeiro resistência à tetraciclina (TET).

A extração do pDNA (DNA plasmídico), foi realizada de acordo com o "kit" de extração e purificação "E.Z.N.A. Plasmid DNA mini kit D6945-02" (Omega bio-tek) (Anexo 1) e seguiu-se o "Spin Protocol". Seguiu-se o passo opcional para equilíbrio da coluna. Utilizou-se 40 µl de tampão de eluição, a 70ºC, pois melhora o rendimento na eluição do pDNA com peso molecular superior a 10kb.

3.2. Amplificação de sequências especificas para identificação do subgrupo de plasmídeos IncP-1Ɛ

Os *primers* são únicos para a sequência alvo a ser amplificada e devem preencher certos critérios, tais como: tamanho do *primer*, %GC, temperatura de *annealing* e de *melting*, estabilidade de extremidade 5', especificidade de extremidade 3', entre outras (Dieffenbach et al., 1995).

Os *primers* foram desenhados para amplificar um fragmento de 281 bp (pares de bases) do gene *trfA* a partir de plasmídeos pertencentes aos subgrupos α, β e Ɛ, do grupo de incompatibilidade IncP-1. Estes *primers* foram designados *trfA_fw and trfA_rev* (Bahl et al., 2009).

3.3. Amplificação das regiões acessórias de plasmídeos IncP-1Ɛ

3.3.1. Desenho de *primers*

O desenho dos *primers* para amplificação das zonas acessórias nos plasmídeos em estudo, delimitadas pelos genes (*parA* e *traC*) e (*klcB* e *trfA*), foi realizado através da seleção das sequências de plasmídeos alvo, pertencentes ao grupo de incompatibilidade IncP-1 do subgrupo ε, que se encontram disponíveis na base de dados "Genbank" do *website* NCBI (http://www.ncbi.nlm.nih.gov/). De seguida, as sequências foram alinhadas usando um software

de alinhamento (Clustal Omega) permitindo a seleção das zonas alvo para o desenho dos *primers*. Utilizou-se a ferramenta online (OligoCalc), para verificar a complementaridade dos *primers (EtraC_fw* e *EparA_rev)* e (*EtrfA_fw* e *D/EklcA*_rev) que serão usados para amplificar a partir dos genes flanqueadores da região acessória dos plasmídeos do subgrupo IncP-1ε em estudo. A possibilidade de haver sequências idênticas às selecionadas noutros genes foi avaliada, o que poderia ter implicações na especificidade dos *primers*, realizando alinhamentos locais com a ferramenta BLAST.

3.3.2. Amplificação por PCR (Reação em Cadeia da Polimerase)

O PCR é uma amplificação enzimática mediada por *primers* de sequências de DNA. O PCR *touchdown* pode ser integrado como padrão para qualquer PCR para aumentar a sua especificidade e a formação de produto. Contudo, tem também o potencial de superar os problemas associados com temperaturas elevadas de *annealing* necessárias para algumas ligações entre *primer* e molde e é particularmente útil para moldes difíceis de amplificar (Kolmodin & Birch, 2002).

Os *primers trfA_fw* e *trfA_rev* usados ligam-se ao gene *trfA* nos plasmídeos em estudo, foram utilizados para testar a amplificação a partir do pDNA, de modo, a eliminar suspeitas de degradação de DNA e de contaminação após extração quando havia dúvidas se o pDNA teria alguma contaminação que pudesse inibir a reação da polimerase. O produto amplificado esperado seria de 281 bp. Utilizou-se como reagentes, "NZY Taq 2x Green Master Mix", da empresa (Nzytech), que já contém todos os reagentes necessários à amplificação de DNA, incluindo a *Taq* polimerase. Os reagentes utilizados para o programa de PCR foram: 16.25 µl de água destilada; 6.25 µl de "NZY Taq 2x Green Master Mix"; 10 µM de *primer_fwd* e *primer_rev* e 1 µl de pDNA a concentrações variáveis, para um volume total de 25 µl. O programa para amplificação do pDNA em estudo utilizado encontra-se descrito na tabela 3. As reações de PCR decorreram nos termocicladores "My Cicler" (BIO-RAD).

Tabela 3 – Programa de PCR utilizado para os *primers trfA_fw* e *trfA_rev*

Temperatura (ºC)	Tempo (s)	Nº de ciclos
98	30	1
98	20	35
67	20	
72	30	
72	300	1
15	∞	1

Os PCR foram realizados para otimizar as condições de amplificação do DNA alvo, regiões contendo genes acessórios dos plasmídeos do subgrupo IncP-1ε. Os *primers* usados foram (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e D/*EklcA_rev*), estes foram desenhados para amplificar a partir dos genes flanqueadores da região acessória dos plasmídeos em estudo. Foram utilizados como reagentes: 15.5µl de água destilada; 5µl de tampão "PrimeStar GLX 5x PS" (com Mg2+); 2µl de mistura de dNTP's a 2.5 mM; 0.5µl cada de *primer_fwd* e *primer_rev* a 10 µM; 0.5µl de "PrimeStar GXL DNA polimerase" a 1.25U/µl e 1µl de pDNA a concentrações variáveis. A DNA polimerase é da TAKARA #R05DA (enzifarma).

A DNA Polimerase "PrimeSTAR GXL" permite a amplificação de produtos ≥ 30kb mantendo a alta fidelidade. Adequada para moldes de DNA ricos em GC que são de outro modo difíceis de amplificar, esta enzima permite uma amplificação bem-sucedida a partir de moldes desafiadores sem necessidade de otimização extensiva com tampões ou condições de reação. Além disso, a DNA Polimerase "PrimeSTAR GXL" é compatível com uma imensa gama de moldes de DNA e é capaz de uma forte amplificação mesmo na presença de grandes quantidades de DNA não-alvo.

Para amplificação das zonas acessórias utilizou-se um esquema de PCR *touchdown,* tal como mostra o programa otimizado para amplificação das regiões acessórias dos plasmídeos na tabela 4. O tamanho das regiões acessórias para cada plasmídeo e conjunto de *primers* estão apresentados na tabela 2. As reações de PCR decorreram nos termocicladores "My Cicler" (BIO-RAD).

Tabela 4 – Programa de PCR utlizado para os *primers* (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e D/*EklcA_rev*)

Temperatura (ºC)	Tempo (s)	Nº de ciclos
98	10	10
70 – 60 (-1ºC/ciclo)	20	
68	480	
98	10	15
60	20	
68	480	
15ºC	∞	1

3.3.3. Separação dos produtos de amplificação por PCR

Os produtos de PCR dos *primers trfA_fw* e *trfA_rev* foram analisados através de eletroforese em gel de agarose a 1.5%, em TAE (Tris-Acetato-EDTA) (BIO-RAD). Adicionou-se aos poços do gel 4µl de produto de PCR. Adicionou-se também 1µl de marcador de peso molecular "GeneRuler DNA Ladder Mix" (Fermentas). A eletroforese correu a 80V, durante 1h. Decorrida a eletroforese os géis foram corados com uma solução de brometo de etídio (EtBr). O pDNA foi visualizado num sistema de análise e documentação em gel "Molecular Imager Gel Doc XR+" (BIO-RAD).

Os produtos de PCR dos *primers* (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e *D/EklcA_rev*) foram analisados através de eletroforese em gel de agarose a 0.8%. Adicionou-se nos poços do gel 4µl de produto de PCR com 1µl de tampão de carga. A eletroforese correu a 90V, durante 1h. Decorrida a eletroforese os géis foram corados com uma solução de brometo de etídio (EtBr). O pDNA foi visualizado num sistema de análise e documentação em gel "Molecular Imager Gel Doc XR+" (BIO-RAD).

3.4 Digestão de DNA

A digestão de DNA de bacteriófago ƛ com recurso a enzimas de restrição foi realizada de modo a criar um novo marcador de peso molecular. A digestão de pDNA para análise de produtos de PCR de alto peso molecular (> 1 400bp) recorrendo à observação dos perfis de digestão, foi realizada

de modo a determinar com maior certeza qual o peso molecular de cada região acessória dos plasmídeos em estudo.

Para a preparação do novo marcador de peso molecular usou-se DNA do bacteriófago ƛ (ƛDNA) e a enzima de digestão "HindIII Fast-Digest" (#FD0504) (Thermo Scientific), tal como descrito na tabela 5. A digestão decorreu a 37ºC, em banho seco, durante 5 minutos. Os fragmentos da digestão foram analisados por eletroforese em gel de agarose a 0.8%, a 90V, durante 1h. Foram analisados 5 µl dos produtos de digestão.

Tabela 5 - Respetivas concentrações de enzima de digestão para ƛDNA para um volume total de 10 µl.

Reagente	**Volume (µl)**	**Concentração**
Água destilada	4	-
FD Green Buffer	1	1x
ƛDNA	4	0.25µg/µl
HindIII FD	1	10U/µl

A análise de fragmentos de alto peso molecular usou os produtos de PCR obtidos dos plasmídeos em estudo e a enzima de digestão "HindIII Fast-Digest" (#FD0504) (Thermo Scientific), tal como descrito na tabela 6. A digestão decorreu a 37ºC, em banho seco, durante 20 minutos. Os fragmentos da digestão foram analisados por eletroforese em gel de agarose a 1%, a 80V, durante 1h. Foram analisados 10µl dos produtos de digestão.

Tabela 6 - Respetivas concentrações de enzima de digestão para pDNA para um volume total de 10 µl.

Reagente	**Volume (µl)**	**Concentração**
Água destilada	3	-
FD Green Buffer	1	1x
pDNA	5	Variável
HindIII FD	1	10U/µl

3.5 Purificação e sequenciação dos produtos de PCR

Os produtos de PCR foram purificados através do *kit* de purificação de DNA "NZY Gelpure kit" (NZY Tech) (Anexo 2), para serem posteriormente sequenciados. O procedimento foi de acordo com o estabelecido pela empresa com modificações descritas: por cada 19 µl de produto de PCR, foram adicionados 95 µl de tampão de ligação à solução.

Os produtos de PCR purificados (pMLUA3) com adição de *primers EtrfA_fw* e *D/EklcA_rev*, foram enviados para sequenciar na empresa "GATC Biotech", na Alemanha. Posteriormente, as sequências nucleotídicas foram analisadas e comparadas com as sequências disponíveis na base de dados "GenBank" usando a ferramenta de alinhamento local BLAST.

3.6 Análise da informação extraída da base de dados de plasmídeos sequenciados "RefSeq"

A análise da informação relativa aos plasmídeos completamente sequenciados na base de dados do NCBI foi realizada a partir da base de dados "RefSeq" de genomas com data de Janeiro de 2017. Os dados disponíveis na base de dados foram transferidos para uma tabela (Anexo 3). De acordo com os objetivos definidos procedeu-se à listagem e preenchimento, quando os dados estavam incompletos, de detalhes de cada uma das entradas na base de dados. Estes detalhes constituem informação relacionada com o hospedeiro bacteriano, nomeadamente: o ano de isolamento (Year), a área geográfica de origem do isolado (Geography), o ambiente original de isolamento (Source), alguns detalhes que foram considerados importantes, que foram colocados nas colunas detalhes (Details) e detalhes completos (Full Details) e alguns comentários como a indicação de ambientes extremos foram descritos na coluna (Comments). A geografia aponta o país e cidade onde os plasmídeos foram descobertos. A data indica o ano em que foram isolados. A origem indica o ambiente em que os hospedeiros bacterianos foram inicialmente descritos.

O preenchimento dos campos descritivos vazios foi realizado manualmente e recorrendo a informação dispersa no relatório do plasmídeo na base de dados "RefSeq", por exemplo no campo "Features" na bibliografia relacionada e associada à sequência (quando presente). Adicionalmente, foi procurada informação recorrendo a bases de dados bibliográficas realizando pesquisa específica para o plasmídeo, ou estirpe bacteriana hospedeira. Quando aplicável, procurou-se informação disponível nas coleções de culturas como ATCC (www.atcc.org). Por último, quando todas as pesquisas falharam em completar a informação relativa ao ano, geografia ou ambiente, entrou-se em contato com os autores da submissão através de correio eletrónico.
Quando todos os procedimentos descritos acima falharam em detalhar a informação foi acrescentada ND "Not Determined" (Não Determinado) aos campos Geografia (Geography) e Origem (Source). Para o campo Ano (Year) colocou-se a data (ano) de submissão da sequência precedido do símbolo "<".

Para preenchimento da informação relativa ao ambiente de isolamento do hospedeiro bacteriano procurou-se definir os vários compartimentos ambientais. Na tabela 7, estão detalhados os ambientes definidos neste trabalho bem como as suas características gerais e alguns exemplos.

Tabela 7 – Descrição dos ambientes presentes neste estudo e exemplos.

Ambiente (Source)	Descrição:	Exemplo:
Clínico (Clinical)	Hospedeiros bacterianos isolados de indivíduos com patologia.	NC_001372
Potencial clínico (Clinical-potential)	Hospedeiros bacterianos patogénicos ou oportunistas isolados de indivíduos ou outros ambientes sem associação a um estado patológico.	NC_000948
Veterinário (Veterinary)	Hospedeiros bacterianos isolados de animais com patologia.	NC_001774
Plantas e algas (Environmental-plant and algae)	Hospedeiros bacterianos isolados de plantas e algas, associados a raízes, folhas, podendo ainda ser endofíticos ou epifíticos.	NC_001399
Solos (Environmental-soil)	Hospedeiros bacterianos isolados de diferentes tipos de solos.	NC_001988
Águas Residuais (Environmental-wastewaters)	Hospedeiros bacterianos isolados de águas residuais e lamas ativas.	NC_002113
Água Salgada (Environmental-marine)	Hospedeiros bacterianos isolados de massas de água, superfície e sedimentos encontrados em água salgada.	NC_001858
Água Salobra (Environmental-estuarine)	Hospedeiros bacterianos isolados de massas de água, superfície e sedimentos encontrados em água salobra.	NC_010112
Água doce (Environmental-freshwater)	Hospedeiros bacterianos isolados de massas de água, superfície e sedimentos encontrados em água doce.	NC_004964
Humano (Environmental-human)	Hospedeiros bacterianos isolados de humanos, não causadores de patologias.	NC_002133
Animal (Environmental-animal)	Hospedeiros bacterianos isolados de animais (domésticos e selvagens), não causadores de patologia animal.	NC_001431
Comida (Environmental-food)	Hospedeiros bacterianos isolados de alimentos para humanos como outros animais.	NC_000906
Ar (Environmental-air)	Hospedeiros bacterianos isolados de amostras de ar.	
Ambiental (Environmental)	Hospedeiros bacterianos isolados de ambientes não clínicos e que não foram possíveis de determinar com certeza.	NC_001272
Não Determinado (Not Determined) (ND)	Hospedeiros bacterianos isolados de ambientes que não foram possíveis de determinar.	NC_001385

Na coluna Comentários (Comments) foram colocadas informações consideradas pertinentes, como a identificação de um ambiente extremo. Um organismo que prospera em um ambiente extremo é um extremófilo. Todos os fatores encontram-se num *continuum* e extremos desse *continuum* que tornam difícil para um organismo funcionar são extremos. Os extremos incluem extremos físicos, como temperatura, radiação ou pressão e extremos geoquímicos, como dessecação, salinidade, pH (Tabela 7) (Rothschild & Mancinelli, 2001).

Tabela 8 – Classificação de extremófilos e exemplos de ambientes em que se encontram (Rothschild & Mancinelli, 2001).

Parâmetro ambiental	**Tipo**	**Definição**	**Exemplos de ambientes**
Temperatura	Hipertermófilo Termófilo Mesófilo Psicrófilo	> 80ºC 60º-80ºC 15º-60ºC <15ºC	Desertos (Atacama Desert)
Radiação	-	-	-
Pressão	Barófilo Piezófilo	Sobrevive a pesos robustos Sobrevive a fortes pressões	Mar profundo (East Pacific Rise)
Gravidade	Hipergravidade Hipogravidade	>1g <1g	-
Vácuo	-	Tolera o vácuo (espaço sem matéria)	Espaço
Dissecação	Xerófilos	Anidrobiótico	Atmosfera
Salinidade	Halófilo	Sobrevive a grandes concentrações de sal (2-5 M NaCl)	Lagos naturais (Great Salt Lake)
pH	Alcalifilo Acidófilo	pH>9 Sobrevive ao baixo pH	Fontes termais e "geysers"
Concentração de oxigénio	Anaeróbio Microaerófilo Aeróbio	Não consegue tolerar O_2 Tolera algum O_2 Necessita de O_2	-
Extremos químicos	Gases Metais	- Consegue tolerar altas concentrações de metais (metalotolerante)	-

4. Resultados e Discussão

4.1. Identificação e alinhamento múltiplo de sequências das regiões flanqueadoras conservadas do *backbone* dos plasmídeos

O alinhamento múltiplo das sequências das regiões flanqueadoras do *backbone* dos plasmídeos em estudo foi realizado (tabela 9) e selecionaram-se as sequências conservadas que permitiram a construção dos *primers foward* e *reverse*.

Tabela 9 – Alinhamento múltiplo usando o programa (Clustal Omega).

Gene	Plasmídeos	Sequências
trfA	pAKD16	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGACGCATGTTCGATTACT
	pAKD25	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGACGCATGTTCGATTACT
	pAKD34	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGACGCATGTTCGATTACT
	pEMT3	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGACGCATGTTCGATTACT
	pHH128	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pHH3408	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pKJK5	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pKS77	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pMLUA1	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pMLUA3	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pMLUA4	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
	pHH3414	AGTTCATTTGGGAGAAGTACCGCAAGCTGACGCCCACGGCCCGGCGCATGTTCGACTACT
klcA	pHH128	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pHH3408	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pHH3414	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pKJK5	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pKS77	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pMLUA1	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pMLUA3	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pMLUA4	CGCCGACTGGCCGAAAGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pAKD16	CGCCGACTGGCCGAAGGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pAKD25	CGCCGACTGGCCGAAGGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pAKD34	CGCCGACTGGCCGAAGGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
	pEMT3	CGCCGACTGGCCGAAGGCTACAACGGCGGGTTCTGGAACTACTACACGCTGACCAATGGC
traC	pAKD16	ATCTTCCCGATCTTCGCGCCAGGCGAGCAGGCGGGCGATCCCAAGGGCTTCACCGACTTC
	pAKD25	ATCTTCCCGATCTTCGCGCCAGGCGAGCAGGCGGGCGATCCCAAGGGCTTCACCGACTTC
	pAKD34	ATCTTCCCGATCTTCGCGCCAGGCGAGCAGGCGGGCGATCCCAAGGGCTTCACCGACTTC
	pEMT3	ATTTTCCCGATCTTCGCGCCAGGCGAGCAGGCGGGCGATCCCAAGGGCTTCACCGACTTC
parA	pHH128	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pHH3408	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pKJK5	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pKS77	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pMLUA1	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pMLUA3	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pMLUA4	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG
	pHH3414	TCGATCCGGGCCAAGGGCGCCAGGCTAGCCGTGCCTGGTGTGGTGGATTTGACGGAGCTG

4.1.1. *Primers* para amplificação da região acessória dos plasmídeos do subgrupo IncP-1Ɛ

A partir do uso da ferramenta (OligoCalc) foi possível verificar que nenhum dos *primers* apresentou potencial de formação de *hairpins*, complementaridade com 3'-5' e que não possuíam potencial de *mis-match*.

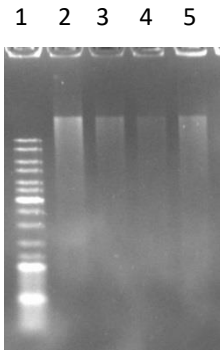
Recorrendo à ferramenta BLAST, do NCBI (http://www.ncbi.nlm.nih.gov/), verificou-se que para cada sequência existia 100% de identidade. Este passo foi importante para percebermos se havia risco dos *primers* não serem específicos para as sequências alvo dos plasmídeos em estudo. Na tabela 9 é possível ver as características dos *primers* utilizados para amplificação das zonas contendo genes acessórios associados a plasmídeos do subgrupo de incompatibilidade IncP-1ε.

Tabela 10 – Características dos *primers* em estudo para o subgrupo de incompatibilidade IncP-1ε.

Primer	5'-3'	Tm (ºC)	% GC	Nº bases
EtrfA_fwd2	*agctgacgcccacggccc*	59.4	77.8	18
D/EKlcA_rev2	*gtagtagttccagaacccgccg*	58.6	59.1	22
EtraC_fwd2	*aggcgggcgatcccaagggcttca*	64	67	24
EparA_rev2	*accacaccaggcacggctagcc*	62	68	22

4.1.2. PCR de longo alcance em amostras controlo

Ao realizarmos a extração de DNA plasmídico das estirpes bacterianas hospedeiras dos plasmídeos em estudo, efetuámos uma eletroforese em gel de agarose para confirmar se a extração havia sido bem-sucedida. O resultado pode ser observado na figura 4.



1 – Marcador de peso molecular

2 – pMLUA1

3 – pMLUA3

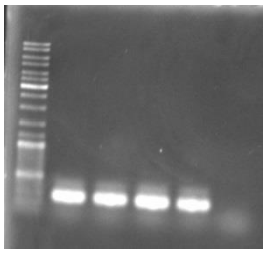
4 – pMLUA4

5 – pKJK5

Figura 4 - Análise por eletroforese em gel de agarose do pDNA dos plasmídeos em estudo (pMLUA1, pMLUA3, pMLUA4 e pKJK5) após extração. O marcador de peso molecular usado foi o "GeneRuler DNA Ladder Mix" (Fermentas).

Após análise do gel de agarose foi possível confirmar a presença dos plasmídeos em estudo.

Ao verificarmos a presença dos plasmídeos em estudo, o próximo passo foi verificar se estes apresentavam degradação do DNA ou contaminação após a extração, para isso utilizámos os *primers trfA_fw* e *trfA_rev* que se ligam ao gene *trfA* dos plasmídeos. Após o PCR ter sido realizado, efetuámos a eletroforese em gel, o resultado obtido pode ser observado na figura 5. O produto amplificado esperado seria de 281 bp.



1 – Marcador de peso molecular

2 – pMLUA1 **(281 bp)**

3 – pMLUA3 **(281 bp)**

4 – pMLUA4 **(281 bp)**

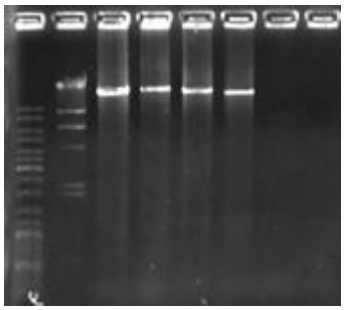
5 – pKJK5 **(281 bp)**

6 – Controlo negativo

Figura 5 - Análise por eletroforese em gel de agarose dos produtos de PCR obtidos com os plasmídeos em estudo (pMLUA1, pMLUA3, pMLUA4 e pKJK5) usando os *primers trfA_fw* e *trfA_rev* – fragmentos de 281 bp. O marcador de peso molecular usado foi o "GeneRuler DNA Ladder Mix" (Fermentas).

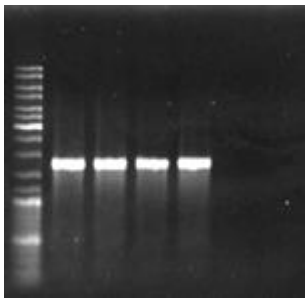
Após análise do gel de agarose foi possível confirmar que os plasmídeos em estudo não apresentavam degradação do DNA ou contaminação após a extração e que apresentavam o tamanho esperado de 281 bp.

Para verificar se os *primers* desenhados amplificavam a região acessória foram realizadas eletroforeses em gel de agarose para cada par de *primers* (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e D/*EklcA_rev*) (figura 6 e 7). Para estas eletroforeses foi adicionado um novo marcador de bases (ƛDNA) e um novo controlo negativo, um plasmídeo do grupo de incompatibilidade IncP-1β, que permitiria verificar se estes *primers* não amplificam outros subgrupos do grupo de incompatibilidade IncP-1, além do Ɛ. O pDNA foi diluído de 1:10 nestas amostras.



1 – Marcador de peso molecular
2 – ƛDNA
3 – pMLUA1 **(18 588 bp)**
4 – pMLUA3 **(17 572 bp)**
5 – pMLUA4 **(15 188 bp)**
6 – pKJK5 **(14 093 bp)**
7 – pB4 **(-)**
8 – Controlo negativo

Figura 6 - Análise por eletroforese em gel de agarose dos produtos de PCR obtidos com os plasmídeos em estudo (pMLUA1, pMLUA3, pMLUA4 e pKJK5) usando os *primers EtraC_fw* e *EparA_rev* – fragmentos variáveis entre 14 000 e 19 000 bp. O marcador de peso molecular usado foi o "GeneRuler DNA Ladder Mix" (Fermentas).



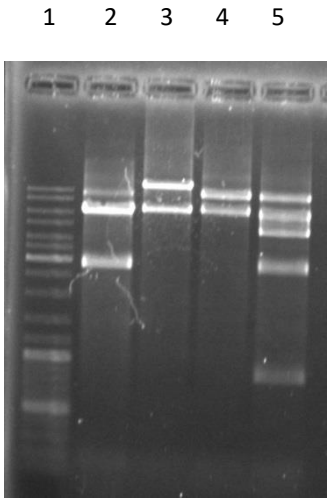
1 – Marcador de peso molecular
2 - pMLUA1 **(1 900 bp)**
3 – pMLUA3 **(1 900 bp)**
4 – pMLUA4 **(1 900 bp)**
5 – pKJK5 **(1 900 bp)**
6 – pB4 **(-)**
7 – Controlo negativo

Figura 7 - Análise por eletroforese em gel de agarose dos produtos de PCR obtidos com os plasmídeos em estudo (pMLUA1, pMLUA3, pMLUA4 e pKJK5) usando os *primers EtrfA_fw* e D/*EklcA_rev* – fragmentos de 1 900 bp. O marcador de peso molecular usado foi o "GeneRuler DNA Ladder Mix" (Fermentas).

Após análise dos géis de agarose é possível observar que os *primers* desenhados amplificam a região pretendida.

4.1.3. Confirmação dos produtos de sequenciação

Realizámos a digestão dos produtos de PCR amplificados, usando os *primers EtraC_fw* e *EparA_rev*, de modo a melhor avaliar o tamanho da região acessória dos plasmídeos em estudo e obtivemos o resultado da figura 8.



1 – Marcador de peso molecular

2 – pMLUA1

3 –pMLUA3

4 – pMLUA4

5 – pKJK5

Figura 8 - Análise por eletroforese em gel de agarose dos produtos de PCR obtidos com os plasmídeos em estudo (pMLUA1, pMLUA3, pMLUA4 e pKJK5) após digestão do pDNA. O marcador de peso molecular usado foi o "GeneRuler DNA Ladder Mix" (Fermentas).

Após análise do gel de agarose é possível concluir que os plasmídeos em estudo possuem todos tamanhos diferentes que podem ser calculados através da soma dos fragmentos de pDNA.

Sequenciamos um fragmento de pDNA do plasmídeo pMLUA3 que foi amplificado com os *primers EtrfA_fw* e *D/EklcA_rev*. Sequenciamos este fragmento por ter um pequeno tamanho que seria facilmente sequenciado e analisado e nos permitiria confirmar a especificidade da amplificação para os plasmídeos em estudo.

4.2. Discussão da metodologia utilizada

O sucesso desta metodologia está relacionado com a escolha da polimerase. A DNA Polimerase "PrimeSTAR GXL" permite a amplificação de fragmentos de DNA longos que não podem ser obtidos usando outras enzimas de PCR de alta fidelidade disponíveis. A polimerase que utilizámos foi escolhida por conseguir amplificar fragmentos de DNA de grande tamanho, ≥ 30kb, mantendo a alta fidelidade. Na descrição da polimerase vê-se que há um limite para o tamanho espectável dos produtos de PCR. A amplificação foi confirmada para fragmentos até 30kb, utilizando DNA genómico humano como molde, fragmentos até 40kb, utilizando λDNA como molde e fragmentos até 13,5kb, utilizando cDNA como molde.

Não tem de necessariamente ser a adotada para este trabalho, mas tem de ser uma polimerase que seja capaz de amplificar longos produtos e com poucos erros. Amplificações não específicas são normais quando se tentam abordagens como esta e o recurso ao esquema de PCR touchdown parece ter diminuído/resolvido este problema. O PCR *touchdown* pode ser integrado como padrão para qualquer PCR para aumentar a sua especificidade e a formação de produto. Contudo, tem também o potencial de superar os problemas associados com temperaturas elevadas de *annealing* necessárias para algumas ligações entre *primer* e molde e é particularmente útil para moldes difíceis de amplificar (Kolmodin & Birch, 2002).

4.3. Análise da tabela contendo os plasmídeos presentes na base de dados do NCBI

Iniciámos este estudo com 4 315 sequências de plasmídeos isolados de hospedeiros bacterianos, até à data de Janeiro de 2017. Inicialmente tínhamos cerca de 3 601 (83,5%) atribuições vazias na para a data de isolamento de plasmídeos, cerca de 2 473 (57,3%) atribuições vazias para geografia/local de isolamento de plasmídeos e cerca de 1 972 (45,7%) atribuições vazias relativamente ao isolamento de plasmídeos.

A tabela apresentava 4 302 sequências de plasmídeos isolados de hospedeiros bacterianos, até à data de Março de 2017, devido à eliminação de algumas das sequências após revisão pelo NCBI. No período de tempo decorrido desde o início deste estudo, houve entrada e saída de sequências de plasmídeos e revisão às sequências já existentes.
As sequências dos plasmídeos presentes na base de dados "GenBank" foram analisadas e após análise conseguimos preencher a maioria dos campos, dos quais ficaram por preencher parte da geografia e parte da origem de isolamento dos hospedeiros bacterianos destes plasmídeos. Concluído o estudo, a tabela apresentava cerca de 1 145 (26,6%) campos caracterizados com ND (Não definidos) nas atribuições para geografia/local de isolamento de plasmídeos e cerca de 185 (4,3%) campos caracterizados como ND nas atribuições para origem de isolamento de plasmídeos.

Após a realização deste estudo alguns dos campos permaneceram vazios apesar do nosso esforço para completar a tabela por completo. Deste modo, tentámos contactar com os autores dos artigos nos quais foram publicadas primeiramente as sequências dos plasmídeos, alguns dos quais tiveram a disponibilidade para responder às nossas questões. Tentámos procurar a informação em falta nas coleções de culturas internacionais como ATCC (American Type Culture Collection), as quais nem sempre possuíam a informação completa que pretendíamos obter. Tentámos obter informação de patentes, que não nos permitiram obter informações completas sobre os hospedeiros bacterianos dos plasmídeos em estudo.
A maioria dos plasmídeos tem uma descrição da fonte original, mesmo que isso às vezes não seja recuperável de uma maneira simples (Smillie et al., 2010).

Os plasmídeos foram classificados de acordo com: geografia, data, origem e algumas características que foram consideradas importantes. A origem foi considerada uma das características mais importantes, uma vez que indicava o local de isolamento dos hospedeiros

bacterianos dos plasmídeos em estudo. Na figura 9, estão representadas as diferentes origens de onde se isolaram os hospedeiros bacterianos dos plasmídeos em estudo.

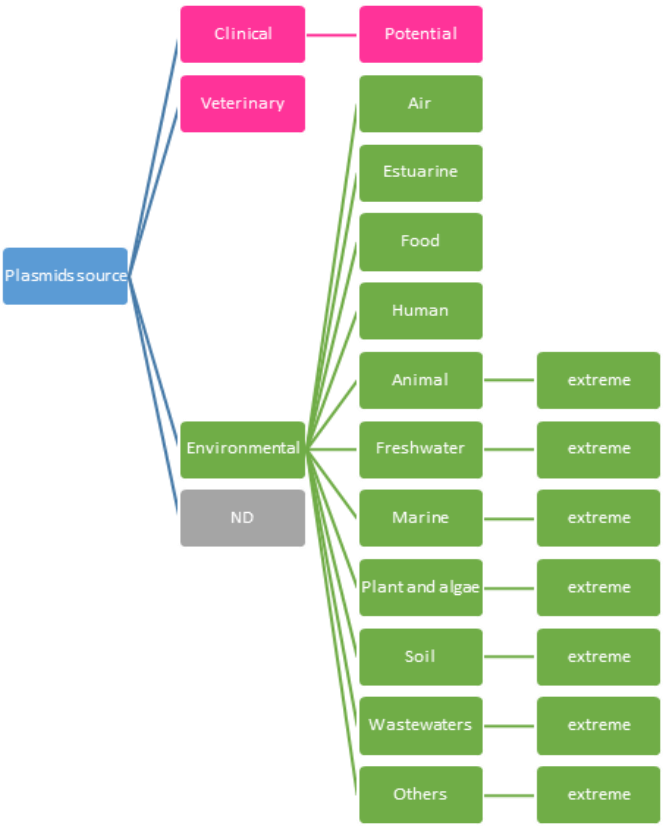
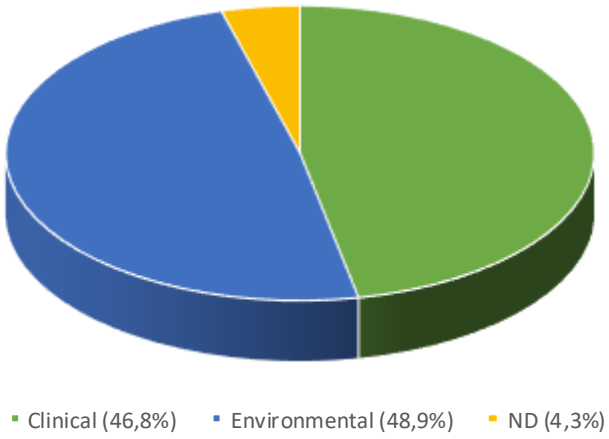


Figura 9 – Esquema ilustrativo com a origem de isolamento dos hospedeiros bacterianos dos plasmídeos em estudo.

Um dos aspetos decidido inicialmente foi a diferenciação entre isolamento clínico e ambiental. Foi realizada uma análise em que se comparou o número de plasmídeos cujos hospedeiros provêm de origem clínica *versus* origem ambiental e ainda que provêm de ambientes desconhecidos. Assim, obtivemos 2 014 (46,8%) plasmídeos de hospedeiros bacterianos provenientes de ambientes clínicos *versus* 2 103 (48,9%) plasmídeos de hospedeiros bacterianos provenientes de outros ambientes. Não nos foi possível determinar a origem ambiental de 185 (4,3%) plasmídeos, como é possível visualizar na figura 10.



*ND – Não definido

Figura 10 – Percentagem de plasmídeos com origem clínica, ambiental e origem desconhecida (não definida), representada por ND. As origens clínicas incluem ambientes clínicos, potenciais clínicos e veterinários. As origens ambientais, incluem os restantes ambientes encontradas e descritos neste estudo. As origens desconhecidas incluem todos os ambientes que não foram possíveis de identificar.

Na figura 10 é possível verificar cerca de 50% de plasmídeos associados a ambientes clínicos e uma quantidade semelhante de plasmídeos associados a ambientes não clínicos. No entanto, as origens ambientais apresentam mais 89 (2%) sequências de plasmídeos do que sequências de plasmídeos associados a ambientes clínicos.

Os ambientes clínicos foram divididos em três categorias, duas para humanos e uma para outros animais (tabela 7). Da análise dos dados verificou-se que temos 1 367 (67,9%) plasmídeos com hospedeiros bacterianos provenientes de origens clínicas, 272 (13,5%) sequências de plasmídeos com hospedeiros bacterianos provenientes de origens potenciais clínicas e 375 (18,6%) plasmídeos com hospedeiros bacterianos provenientes de origens veterinárias, como é possível visualizar na figura 11.

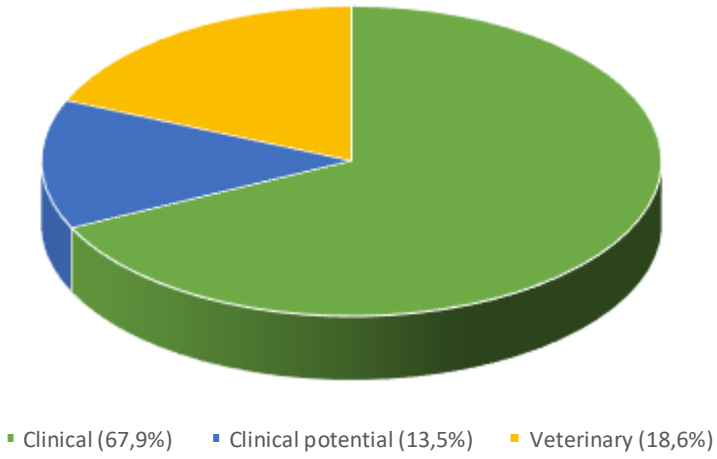


Figura 11 – Percentagem de plasmídeos cujos hospedeiros se encontram em ambientes clínicos, em ambientes potencialmente clínicos e em ambientes veterinários. As origens clínicas incluem doentes humanos. As origens potenciais clínicas incluem ambientes diversos em que se encontrem bactérias com potencial para causar doença em humanos. As origens veterinárias incluem animais doentes.

Na figura 11, é possível verificar que as origens clínicas representam a maioria das sequências de plasmídeos analisadas (68%), seguidas pelas origens veterinárias (19%) e potenciais clínicas (13%), mostrando que as motivações e preocupações com a saúde humana lideram os projetos de sequenciação.

Relativamente aos grupos bacterianos mais representados nos ambientes clínicos, verificou-se a existência de 1 040 (51,6%) plasmídeos com hospedeiros bacterianos provenientes do filo *Proteobacteria*, 426 (21,2%) plasmídeos com hospedeiros bacterianos provenientes do filo *Firmicutes* e 402 (20%) plasmídeos com hospedeiros bacterianos provenientes do filo *Spirochaetes*. Menos representados estão os filos *Chlamydiae* com 65 (3,2%) plasmídeos, *Actinobacteria* com 47 (2,3%) plasmídeos, *Bacteroidetes* com 16 (0,8%) plasmídeos, *Tenericutes* com 13 (0,7%) plasmídeos e *Fusobacteria* com 5 (0,2%) plasmídeos, como é possível visualizar na figura 12.

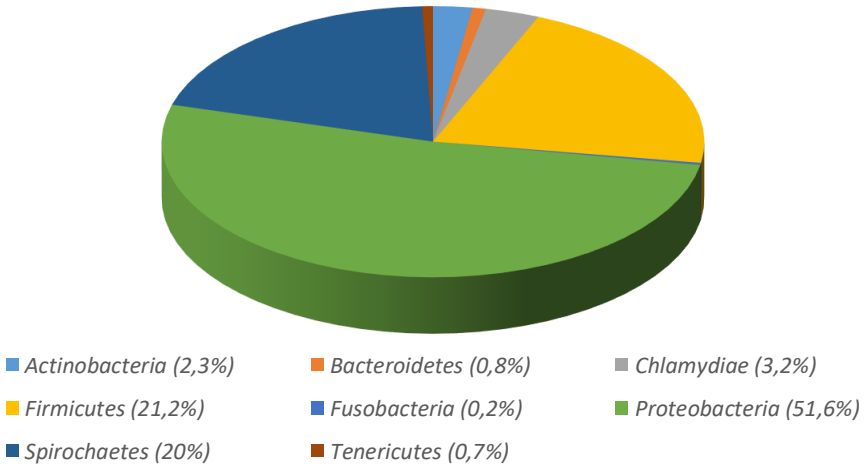


Figura 12 – Percentagem de plasmídeos cujos hospedeiros bacterianos isolados de ambientes clínicos provêm de diferentes filos, tais como, *Actinobacteria, Bacteroidetes, Chlamydiae, Firmicutes, Fusobacteria, Proteobacteria, Spirochaetes e Tenericutes.*

Representantes bacterianos de *Spirochaetes, Firmicutes e Proteobacteria* são amplamente amostrados provavelmente porque incluem os plasmídeos mais associados com a disseminação de resistência a antibióticos entre bactérias patogénicas humanas (Shintani, Sanchez & Kimbara, 2015; Smillie et al., 2010).

Nas origens ambientais foi ainda possível subdividi-las em onze categorias, sendo que em uma delas não foi possível discernir a origem de forma específica (tabela 7). Da análise de dados verificou-se que obtivemos 430 (20,4%) plasmídeos com hospedeiros bacterianos provenientes de alimentos, 403 (19,2%) plasmídeos com hospedeiros bacterianos provenientes de solos e 346 (16,5%) plasmídeos com hospedeiros bacterianos provenientes de plantas e algas. Menos representados estão os ambientes de animais com 221 (10,5%) plasmídeos, de água doce com 199 (9,5%) plasmídeos, de água salgada com 147 (7%) plasmídeos, de humanos com 128 (6,1%) plasmídeos, de ambientes não especificados com 112 (5,3%) plasmídeos, de águas residuais com 96 (4,6%) plasmídeos, de águas salobras com 15 (0,7%) plasmídeos e do ar com 6 (0,3%) plasmídeos, como é possível visualizar na figura 13.

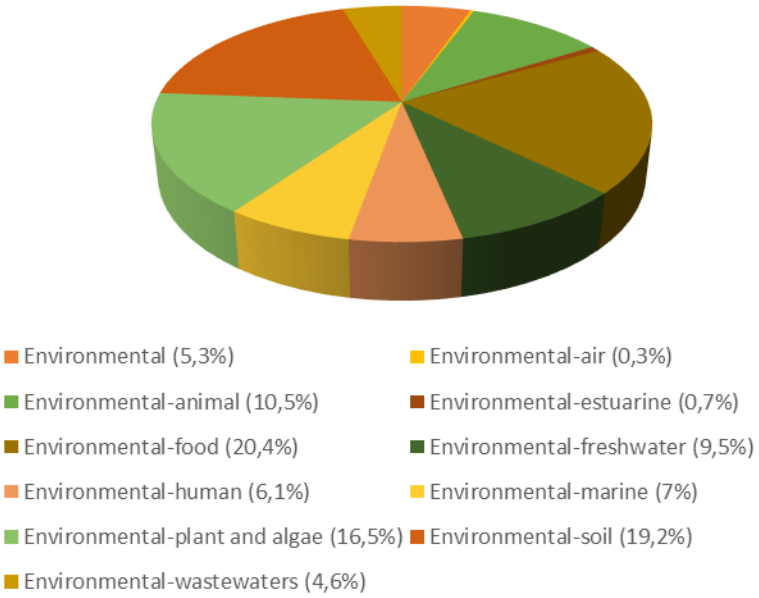


Figura 13 - Percentagem de plasmídeos cujos hospedeiros foram encontrados em ambientes não especificados, no ar, em animais, em estuários, em alimentos, em água doce, em humanos, em água salgada, em plantas e algas, em solos e em águas residuais.

É possível verificar que foram sequenciados plasmídeos um pouco de cada ambiente, com alguns ambientes ligeiramente mais favorecidos. Tal pode ser devido a que estes ambientes tenham maior interesse para a biotecnologia, para o estudo das comunidades bacterianas ou para a transferência horizontal de genes.

Relativamente aos grupos bacterianos mais representados nos restantes ambientes estudados, verificou-se a existência de 942 (44,79%) plasmídeos com hospedeiros bacterianos provenientes do filo *Proteobacteria*, 626 (29,77%) plasmídeos com hospedeiros bacterianos provenientes do filo *Firmicutes* e 203 (9,65%) plasmídeos com hospedeiros bacterianos provenientes do filo *Actinobacteria*. Menos representados estão os filos *Cyanobacteria* com 130 (6,18%) plasmídeos, *Bacteroidetes* com 51 (2,43%) plasmídeos, *Tenericutes* com 49 (2,33%) plasmídeos, *Deinococcus-Thermus* com 39 (1,85%) plasmídeos, Não Definido (ND) com 18 (0,86%) plasmídeos, *Spirochaetes* com 11 (0,52%) plasmídeos, *Planctomycetes* com 6 (0,29%) plasmídeos, *Acidobacteria* com 5 (0,24%) plasmídeos, *Fusobacteria* com 5 (0,24%) plasmídeos, *Thermotogae* com 4 (0,19%) plasmídeos, *Aquificae* com 3 (0,14%) plasmídeos, *Elusimicrobia* com 3 (0,14%) plasmídeos, *Chlorobi* com 2 (0,1%) plasmídeos, *Deferribacteres* com 2 (0,1%) plasmídeos, *Nitrospirae* com 2

(0,1%) plasmídeos, *Chloroflexi* com 1 (0,05%) plasmídeo e *Synergistetes* com 1 (0,05%) plasmídeo, como é possível visualizar na figura 14.

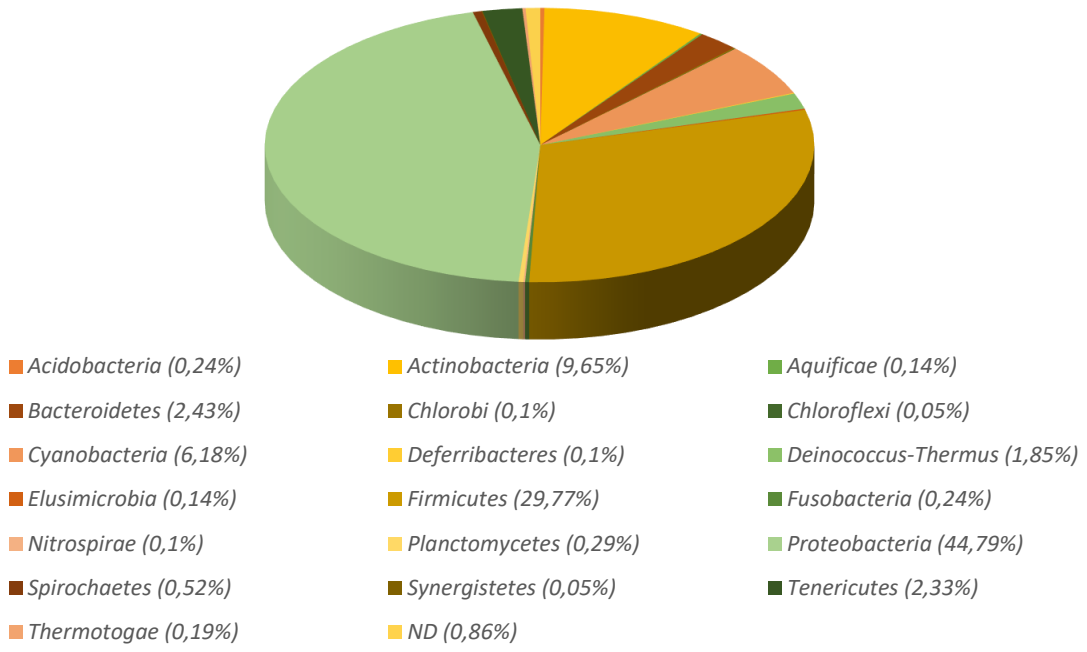
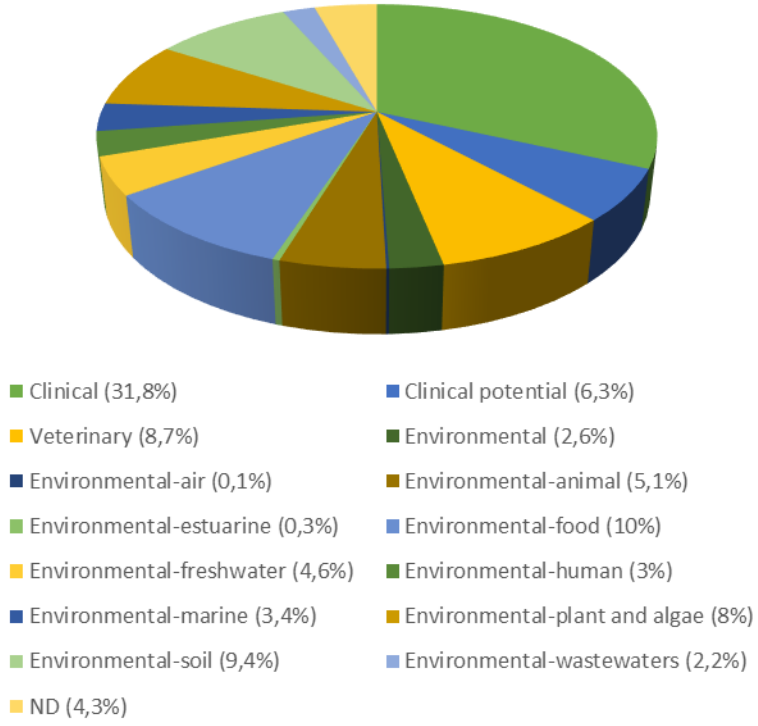


Figura 14 – Percentagem de plasmídeos cujos hospedeiros isolados de ambientes não clínicos provêm de diferentes filos, tais como, *Acidobacteria, Actinobacteria, Aquificae, Bacteroidetes, Chlorobi, Chloroflexi, Cyanobacteria, Deferribacteres, Deinococcus-Thermus, Elusimicrobia, Firmicutes, Fusobacteria, Nitrospirae, Planctomycetes, Proteobacteria, Spirochaetes, Synergistetes, Tenericutes, Thermotogae* e hospedeiros cujo filo é desconhecido (ND).

O filo *Proteobacteria* é um dos mais estudados porque inclui plasmídeos que infetam tanto animais como plantas. Plasmídeos encontrados em bactérias pertencentes ao filo *Firmicutes* são responsáveis por infeções hospitalares e por avanços biotecnológicos na indústria alimentar. Plasmídeos encontrados em bactérias pertencentes ao filo *Actinobacteria* são usados em biotecnologia (Shareck et al., 2004; Shintani, Sanchez & Kimbara, 2015).

Ao realizar a análise à distribuição geral dos plasmídeos por origem, obtivemos 1 367 (31,8%) plasmídeos com hospedeiros bacterianos provenientes de ambientes clínicos, 430 (10%) plasmídeos com hospedeiros bacterianos provenientes de alimentos e 403 (9,4%) plasmídeos com hospedeiros bacterianos provenientes de solos. Menos representados estão os ambientes

veterinários com 375 (8,7%) plasmídeos, de plantas e algas com 346 (8%) plasmídeos, potenciais clínicos com 272 (6,3%) plasmídeos, de animais com 221 (5,1%) plasmídeos, de água doce com 199 (4,6%) plasmídeos, não definidos (ND) com 185 (4,3%) plasmídeos, de água salgada com 147 (3,4%) plasmídeos, de humanos com 128 (3%) plasmídeos, ambientes não especificadas com 112 (2,6%) plasmídeos, de águas residuais com 96 (2,2%) plasmídeos, de água salobra com 15 (0,3%) plasmídeos e do ar com 6 (0,1%) plasmídeos, como é possível visualizar na figura 15.



*ND – Não definido

Figura 15 - Percentagem de plasmídeos cujos hospedeiros foram encontrados em ambientes clínicos, potenciais clínicos, veterinários, não especificadas, no ar, animais, água salobra, alimentos, água doce, humanos, água salgada, plantas e algas, solos, águas residuais e ambientes desconhecidos (não definidos), representados por ND.

É possível verificar que os plasmídeos sequenciados provêm um pouco de cada ambiente, com alguns ambientes ligeiramente mais favorecidos que outros. Tal pode ser devido a que estes ambientes sejam mais estudados devido ao seu impacto humano e por outros interesses biotecnológicos.

Relativamente aos grupos bacterianos mais representados nos ambientes estudados, verificou-se a existência de 2 099 (48,79%) plasmídeos com hospedeiros bacterianos provenientes do filo *Proteobacteria*, 1 100 (25,57%) plasmídeos com hospedeiros bacterianos provenientes do filo *Firmicutes* e 413 (9,6%) plasmídeos com hospedeiros bacterianos provenientes do filo *Spirochaetes*. Menos representados estão os filos *Actinobacteria* com 260 (6,04%) plasmídeos, *Cyanobacteria* com 139 (3,23%) plasmídeos, *Bacteroidetes* com 67 (1,56%) plasmídeos, *Chlamydiae* com 65 (1,51%) plasmídeos, *Tenericutes* com 62 (1,44%) plasmídeos, *Deinococcus-Thermus* com 40 (0,93%) plasmídeos, Não Definido (ND) com 18 (0,42%) plasmídeos, *Fusobacteria* com 10 (0,23%) plasmídeos, *Planctomycetes* com 6 (0,14%) plasmídeos, *Acidobacteria* com 5 (0,12%) plasmídeos, *Thermotogae* com 4 (0,09%) plasmídeos, *Aquificae* com 3 (0,07%) plasmídeos, *Elusimicrobia* com 3 (0,07%) plasmídeos, *Chlorobi* com 2 (0,05%) plasmídeos, *Deferribacteres* com 2 (0,05%) plasmídeos, *Nitrospirae* com 2 (0,05%) plasmídeos, *Chloroflexi* com 1 (0,02%) plasmídeo e *Synergistetes* com 1 (0,02%) plasmídeo, como é possível visualizar na figura 16.

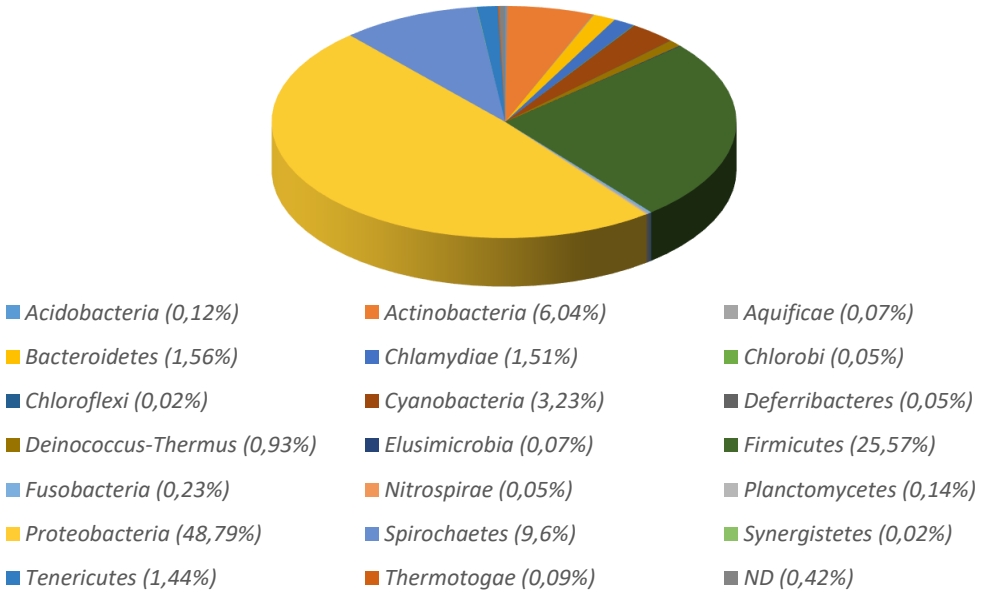


Figura 16 - Percentagem de plasmídeos cujos hospedeiros provêm de diferentes filos, tais como, *Acidobacteria, Actinobacteria, Aquificae, Bacteroidetes, Chlamydiae, Chlorobi, Chloroflexi, Cyanobacteria, Deferribacteres, Deinococcus-Thermus, Elusimicrobia, Firmicutes, Fusobacteria, Nitrospirae, Planctomycetes, Proteobacteria, Spirochaetes, Synergistetes, Tenericutes, Thermotogae* e bactérias cujo filo é desconhecido (ND).

A maioria das sequências de plasmídeos na base de dados foram identificados nos filos: *Proteobacteria* (47%), *Firmicutes* (25%) e *Spirochaetes* (9%) (Shintani, Sanchez & Kimbara, 2015; Smillie et al., 2010). Os filos de bactérias hospedeiras de plasmídeos mais sequenciados mantém-se ao longo do tempo. Tal pode ser devido a que estes despertem maior interesse, tanto a nível clínico como aplicações biotecnológicas.

Desde 1982, a Comissão Europeia apoiou a investigação, a formação e a comercialização de tecnologias no domínio dos extremófilos. As indústrias como a síntese química, detergentes e lavandaria, produtos farmacêuticos e produtos agrícolas, são algumas das aplicações dos extremófilos. A saúde humana pode também beneficiar destes através da biotecnologia e da biorremediação (Rothschild & Mancinelli, 2001).

Realizou-se uma análise em que obtivemos um total de 210 plasmídeos com hospedeiros bacterianos isolados de ambientes extremos. Assim, obtivemos 79 (37,62%) plasmídeos com hospedeiros isolados de água doce (temperatura e pH), 57 (27,14%) plasmídeos com hospedeiros isolados de solos (extremos químicos e radiação) e 36 (17,14%) plasmídeos com hospedeiros isolados de água salgada (temperatura e pH). Menos representados estão os ambientes de águas residuais (extremos químicos) com 24 (11,43%) plasmídeos, não especificados (extremos químicos) com 9 (4,29%) plasmídeos, de animais (radiação) com 4 (1,9%) plasmídeos e de plantas e algas (temperatura) com 1 (0,48%) plasmídeo, como é possível averiguar na figura 17.

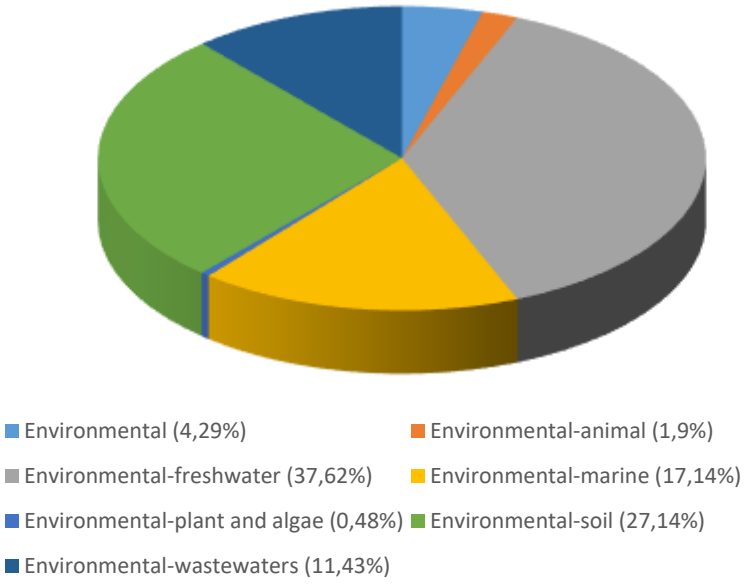


Figura 17 - Percentagem de plasmídeos cujos hospedeiros foram encontrados em ambientes extremos, tais como, ambientes não especificados, animais, fontes de água doce, fontes de água salgada, plantas e algas, solos e águas residuais.

Relativamente aos grupos bacterianos mais representados nos ambientes extremos, verificou-se a existência de 91 (43,33%) plasmídeos com hospedeiros bacterianos provenientes do filo *Proteobacteria*, 35 (16,67%) plasmídeos com hospedeiros bacterianos provenientes do filo *Deinococcus-Thermus* e 32 (15,24%) plasmídeos com hospedeiros bacterianos provenientes do filo *Firmicutes*. Menos representados estão os filos, *Bacteroidetes* com 14 (6,7%) plasmídeos, *Actinobacteria* com 12 (5,7%) plasmídeos, *Cyanobacteria* com 8 (3,8%) plasmídeos, *Acidobacteria* com 5 (2,4%) plasmídeos, *Aquificae* com 3 (1,4%) plasmídeos, *Thermotogae* com 3 (1,43%) plasmídeos, *Deferribacteres* com 2 (0,95%) plasmídeos, *Nitrospirae* com 2 (0,95%) plasmídeos, *Chlorobi* com 1 (0,5%) plasmídeo, *Chloroflexi* com 1 (0,5%) plasmídeo e *Planctomycetes* com 1 (0,48%) plasmídeo, como é possível visualizar na figura 18.

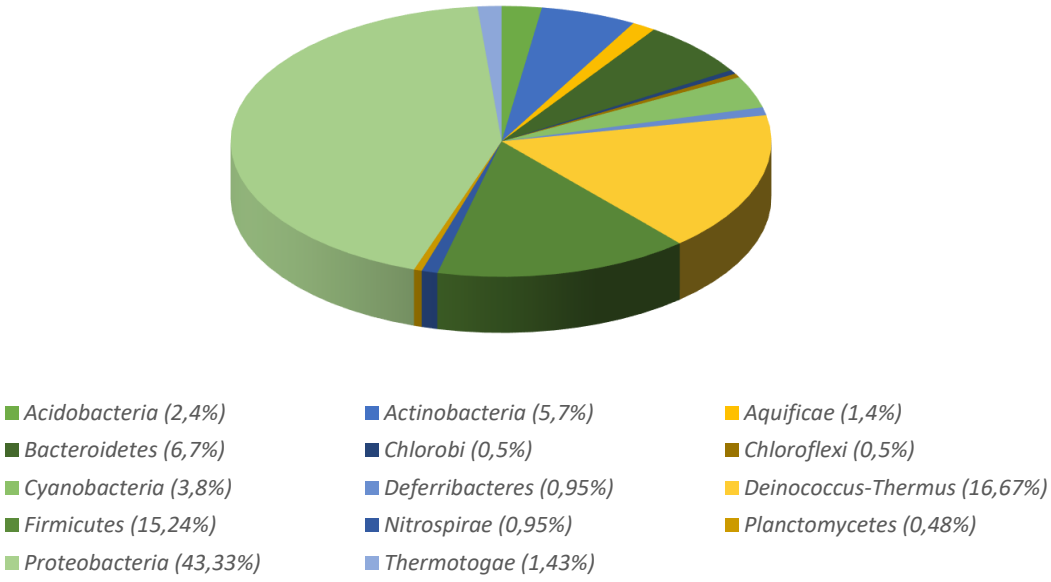


Figura 18 – Percentagem de plasmídeos isolados de ambientes extremos cujos hospedeiros provêm de diferentes filos, tais como, *Acidobacteria, Actinobacteria, Aquificae, Bacteroidetes, Chlorobi, Chloroflexi, Cyanobacteria, Deferribacteres, Deinococcus-Thermus, Firmicutes, Nitrospirae, Planctomycetes, Proteobacteria* e *Thermotogae.*

Os filos mais sequenciados são os referidos anteriormente. Tal é devido, a que estes sejam filos com uma elevada presença ambiental, mesmo em ambientes extremos.

5. Conclusão e Perspetivas futuras

Entre os objetivos deste trabalho, foram selecionados os genes conservados do *backbone* de plasmídeos do subgrupo de incompatibilidade IncP-1ε que são conhecidos por ser *hotspots* para a inserção de genes acessórios. De seguida foram realizados os alinhamentos dos genes entre todos os plasmídeos sequenciados do subgrupo IncP-1ε e os *primers* que abrangem os genes alvo para este subgrupo de incompatibilidade foram desenhados. Após seleção dos plasmídeos representativos do subgrupo IncP-1ε os *primers* foram validados através da amplificação das regiões acessórias entre os genes conservados do *backbone* e confirmação da especificidade. Deste modo, o objetivo principal do desenvolvimento dos *primers* foi parcialmente concluído.

Com este estudo foi possível verificar que os *primers* (*EtraC_fw* e *EparA_rev*) e (*EtrfA_fw* e D/*EklcA_rev*) desenhados amplificam a região acessória dos plasmídeos do subgrupo de incompatibilidade IncP-1ε.
O sucesso desta metodologia esteve muito relacionado com a escolha da polimerase. Não tem de necessariamente ser a adotada para este trabalho, mas tem de ser uma polimerase que seja capaz de amplificar longos produtos e com poucos erros. Amplificações não específicas são normais quando se tentam abordagens como esta e o recurso ao esquema de PCR touchdown parece ter diminuído/resolvido este problema.

Este trabalho poderá ainda ser mais desenvolvido de forma a que os *primers* usados neste estudo possam ser aplicados em amostras ambientais e possam ser usados na procura e seguimento do fluxo de novos genes em plasmídeos do grupo de incompatibilidade IncP-1. Ainda há trabalho que pode ser desenvolvido no âmbito do desenvolvimento de *primers* para amplificação da região acessória de plasmídeos pertencentes ao grupo de incompatibilidade IncP-1.

Um dos objetivos deste trabalho foi o de procurar completar a informação dispersa e muitas vezes ausente na base de dados de sequências completas de plasmídeos do NCBI. Esta informação inclui detalhes sobre o ano de isolamento, o local de isolamento (pais e cidade) e o ambiente de isolamento original. Este objetivo foi atingido com algumas exceções em que não foi possível determinar a origem ou a geografia em que foram isolados os plasmídeos. Relativamente às datas de isolamento dos plasmídeos, quando não foi possível determiná-las com certeza,

incluiu-se a data de submissão da sequência do plasmídeo, com uma anotação de proximidade à data real.

Com este estudo foi possível concluir que das 4 302 sequências de plasmídeos analisadas, os ambientes mais estudados são o clínico, os alimentos e os solos. Tal pode ser devido a que estes ambientes sejam mais estudados devido ao seu impacto humano e por outros interesses biotecnológicos. *Proteobacteria*, *Firmicutes* e *Spirochaetes*, foram os filos mais estudados. Estes filos são amplamente amostrados porque incluem os plasmídeos mais associados com a disseminação de resistência a antibióticos entre bactérias patogénicas humanas. Além disso, o filo *Proteobacteria* é um dos mais estudados porque inclui plasmídeos que infetam tanto animais como plantas e plasmídeos encontrados em bactérias pertencentes ao filo *Firmicutes*, são responsáveis por avanços biotecnológicos na indústria alimentar.

Os ambientes extremos têm tido muita atenção desde 1982, as bactérias hospedeiras de plasmídeos isoladas de ambientes extremos têm aplicações quotidianas, na biotecnologia e na biorremediação. A partir das 210 sequências de plasmídeos analisadas, foi possível concluir que os ambientes mais estudados são a água doce, a água salgada e os solos. *Proteobacteria*, *Deinococcus-Thermus* e *Firmicutes*, foram os filos mais encontrados. Tal é devido, a que estes sejam filos com uma elevada presença ambiental, mesmo em ambientes extremos.

A análise da informação disponível no "GenBank" pode ser mais desenvolvida ao serem realizadas mais pesquisas da informação que se foquem em outros aspetos. À medida que mais plasmídeos vão sendo sequenciados e publicados na base de dados "GenBank" é possível realizar novos estudos sobre os dados publicados. Estudos deste género dão uma visão geral sobre os plasmídeos, os filos das bactérias hospedeiras, ambientes de onde são isolados e os motivos de sequenciação que são mais utilizados, se a análise ao plasmídeo é a motivação principal ou se apenas foi sequenciado com parte de um projeto de sequenciação do genoma microbiano, que inicialmente não teria interesse no plasmídeo em si.

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7. Anexos

Anexo 1: "E.Z.N.A. Plasmid DNA mini kit D6945-02 - Spin Protocol" (Omega bio-tek)

1. Isolar uma colónia única a partir de uma placa seletiva e inocular em 8 mL de meio LB contendo um antibiótico seletivo (tetraciclina) (TET) a 50 µg/mL. Incubar durante a noite a 30ºC com agitação (180 rpm).
2. Centrifugar a 10 000 x g durante 1 minuto à temperatura ambiente.
3. Decantar ou aspirar e descartar o meio de cultura.
4. Adicionar 250 µL de Solução I/RNase A. Usar o vortex ou pipetar de modo a misturar vigorosamente. A ressuspensão completa do *pellet* das células é fundamental para obter bons resultados.
5. Transferir a suspensão para um novo tubo de microcentrifugadora de 1.5 mL.
6. Adicionar 250 µL de Solução II. Inverter e rodar gentilmente o tubo várias vezes, de modo a obter um lisado transparente.
7. Adicionar 350 µL de Solução III. Inverter imediatamente várias vezes até um precipitado floculado branco se formar.
8. Centrifugar à velocidade máxima (≥ 13 000 x *g*) durante 10 minutos. Um *pellet* compacto branco irá formar-se.
9. Inserir uma "HiBind® DNA Mini Column" num tubo de recolha de 2 mL.

Protocolo para Recalibração da Coluna:

1. Adicionar 100 µL de NaOH a 3M à "HiBind® DNA Mini Column".
2. Centrifugar à velocidade máxima durante 30 segundos.
3. Descartar o filtrado e reutilizar o tubo de recolha.

10. Transferir o sobrenadante transparente do passo 8 aspirando-o cuidadosamente para a "HiBind® DNA Mini Column". Ter o cuidado de não desfazer o *pellet* para que resíduos celulares não sejam transferidos para a "HiBind® DNA Mini Column".
11. Centrifugar à máxima velocidade durante 1 minuto.
12. Descartar o filtrado e reutilizar o tubo de recolha.
13. Adicionar 500 µL de Tampão HB.

14. Centrifugar à velocidade máxima durante 1 minuto.
15. Descartar o filtrado e reutilizar o tubo de recolha.
16. Adicionar 700 µL de Tampão de Lavagem de DNA.
17. Centrifugar à velocidade máxima durante 1 minuto.
18. Descartar o filtrado e reutilizar o tubo de recolha.

Nota: Repetir os passos 16 a 18 para um segundo passo de lavagem de DNA com o Tampão de Lavagem de DNA.

19. Centrifugar a "HiBind® DNA Mini Column" vazia durante 2 minutos à velocidade máxima para secar o núcleo da coluna.
20. Transferir a "HiBind® DNA Mini Column" para o tubo de microcentrifugadora de 1.5 mL limpo.
21. Adicionar 40 µL de Tampão de Eluição aquecido a 70ºC diretamente para o centro da membrana da coluna. O Tampão de Eluição aquecido permite recuperar melhor DNA plasmídico > 10kb.
22. Deixar repousar à temperatura ambiente durante 1 minuto.
23. Centrifugar à velocidade máxima durante 1 minuto.

Anexo 2: Protocolo para limpeza de produtos de PCR “NZY Gelpure kit” (NZY Tech)

1. Transferir o volume da mistura da reação enzimática para um tubo de centrifugadora de 1.5 mL e adicionar 5x de Tampão de Ligação. Misturar ao inverter o tubo várias vezes. Centrifugar (> 12 000 x g) brevemente para colher a amostra. Todos os passos da purificação incluindo a centrifugação devem ser feitos à temperatura ambiente.
2. Adicionar a mistura acima à coluna “NZYTech spin”. Centrifugar durante 30 segundos e descartar o que passar pela coluna.
3. Adicionar 600 µL de Tampão de Lavagem e centrifugar durante 30 segundos. Descartar o que passar pela coluna.
4. Centrifugar durante 1 minuto para secar a membrana da coluna “NZYTech spin” de resíduos de etanol.
5. Colocar a coluna “NZYTech spin” num tubo de centrifugadora limpo de 1.5 mL. Adicionar 20 µL de água ultrapura ao centro da coluna. Centrifugar durante 1 minuto para eluir o DNA.

Accession	Country/Geography	Collection Date	Source
NC_000906	France	1987	environmental-food
NC_000914	Hamburg, Germany	1987	environmental-plant and algae
NC_000923	Cape Town, South Africa	1997	clinical
NC_000937	ND	<1986	environmental-food
NC_000938	ND	<1986	environmental-food
NC_000948	Shelter Island, New York, USA	1982	clinical potential
NC_000949	Shelter Island, New York, USA	1982	clinical potential
NC_000950	Shelter Island, New York, USA	1982	clinical potential
NC_000951	Shelter Island, New York, USA	1982	clinical potential
NC_000952	Shelter Island, New York, USA	1982	clinical potential
NC_000953	Shelter Island, New York, USA	1982	clinical potential
NC_000954	Shelter Island, New York, USA	1982	clinical potential
NC_000955	Shelter Island, New York, USA	1982	clinical potential
NC_000956	Shelter Island, New York, USA	1982	clinical potential
NC_000957	Shelter Island, New York, USA	1982	clinical potential
NC_000958	USA	1956	environmental-food
NC_000959	USA	1956	environmental-food
NC_001272	China	2000	environmental
NC_001275	South Korea	1998	environmental-food
NC_001277	Michigan, USA	1956	environmental-food
NC_001315	Antarctica (France)	1990	environmental-marine
NC_001316	Antarctica (France)	1990	environmental-marine
NC_001370	Norway	1989	environmental-food
NC_001371	Belgium	1957	ND
NC_001372	Bologna, Italy	1986	clinical
NC_001373	ND	1973	clinical potential
NC_001376	USA	1974	environmental-soil
NC_001377	Copenhagen, Denmark	1981	clinical
NC_001378	Vietnam	1984	clinical
NC_001379	Saitama, Japan	1989	environmental-food
NC_001380	Durham, North Carolina, USA	1980	clinical
NC_001381	Paris, France	1981	clinical
NC_001382	Melbourne, Australia	1988	veterinary
NC_001383	West Bengal, India	2009	clinical
NC_001384	United Kingdom	1988	clinical
NC_001385	ND	<2013	ND
NC_001387	ND	<1988	environmental-soil
NC_001388	ND	1948	clinical
NC_001390	Missouri-Montana, USA	1981	clinical
NC_001391	ND	1987	clinical
NC_001393	Bucharest, Romania	1976	clinical
NC_001395	USA	1988	clinical
NC_001399	Japan	1993	environmental-plant and algae
NC_001415	Japan	1985	environmental-soil
NC_001425	Thailand	1991	environmental-soil
NC_001431	Manhattan, USA	2003	environmental-animal
NC_001446	Negev Desert, Israel	1977	environmental-animal
NC_001456	Massachusetts, USA	1972	environmental-soil
NC_001476	ND	<1998	clinical
NC_001496	Utah, USA	<1983	veterinary
NC_001520	Malanjkhand, India	<1993	environmental-soil
NC_001537	Kiev, Ukraine	1992	clinical
NC_001597	Ibaraki, Japan	1982	environmental-freshwater
NC_001670	Bulgaria	1905	environmental-food
NC_001705	Wiurzburg, Germany	1978	environmental-soil
NC_001735	London, UK	1972-3	clinical
NC_001738	South America	1971	environmental-soil
NC_001740	ND	1971	clinical
NC_001755	Isafjardardjup, NW Iceland	1988	environmental-marine
NC_001756	Dallas, USA	1995	clinical
NC_001757	New Zealand	1979	environmental-animal
NC_001758	Ohio, USA	1999	environmental-animal
NC_001759	Mexico	1957	environmental-soil
NC_001760	Japan	1997	environmental-animal

NC_001763	London, UK	1993	clinical
NC_001764	Tokyo, Japan	<1980	environmental-food
NC_001765	Tokyo, Japan	<1980	environmental-food
NC_001766	Tokyo, Japan	<1980	environmental-food
NC_001767	Pusan, Korea	1990	clinical
NC_001772	Monteverde, Costa Rica	1992	environmental-soil
NC_001774	Australia	<1996	veterinary
NC_001787	Marana, Arizona, USA	<1998	veterinary
NC_001791	China	<1987	environmental-soil
NC_001797	Paris, France	1976	clinical
NC_001843	Korea	<1996	clinical
NC_001845	México	1920/30	environmental-food
NC_001848	ND	<1997	clinical
NC_001849	New York, USA	1982	clinical potential
NC_001850	New York, USA	1983	clinical potential
NC_001851	New York, USA	1984	clinical potential
NC_001852	New York, USA	1985	clinical potential
NC_001853	New York, USA	1986	clinical potential
NC_001854	New York, USA	1987	clinical potential
NC_001855	New York, USA	1988	clinical potential
NC_001856	New York, USA	1989	clinical potential
NC_001857	New York, USA	1990	clinical potential
NC_001858	Thondi, India	2011	environmental-marine
NC_001880	Kolbeinsey Ridge, Iceland	1992	environmental-marine
NC_001898	Polomolok, The Philippines	1997	environmental-plant and algae
NC_001903	New York, USA	1982	clinical potential
NC_001904	New York, USA	1982	clinical potential
NC_001910	Russia	<1998	environmental-animal
NC_001911	Russia	<1998	environmental-animal
NC_001949	Cork, Ireland	1998	environmental-food
NC_001974	Miyake-jima island, Japan	1996	environmental-freshwater
NC_001988	Connecticut, USA	1924	environmental-soil
NC_001994	Melbourne, Australia	1983/84	clinical
NC_001995	Melbourne, Australia	1983/84	clinical
NC_002002	USA	<1999	clinical
NC_002013	ND	<1978	clinical potential
NC_002033	South Carolina, USA	1988	environmental-soil
NC_002056	ND	<1998	clinical
NC_002059	Australia	<1997	environmental-animal
NC_002060	Tsukuba, Japan	1982	environmental-freshwater
NC_002061	Japan	<1993	environmental-freshwater
NC_002062	Japan	<1992	environmental-soil
NC_002070	Japan	<1999	environmental-food
NC_002075	Moscow, Russia	1981	environmental-soil
NC_002088	Hong Kong, China	<1996	clinical potential
NC_002090	Middle East	1977	clinical
NC_002091	Israel	1975	environmental-soil
NC_002092	District of Columbia. USA	<1987	environmental-plant and algae
NC_002093	Lyon, France	1981	clinical
NC_002094	India	1954	environmental-food
NC_002095	California, USA	1971	environmental-freshwater
NC_002096	ND	1995	clinical potential
NC_002098	Canada	1985	clinical
NC_002099	china	<1993	environmental-soil
NC_002100	Thailand	<1997	environmental-plant and algae
NC_002102	Kopenhagen, Denmark	1925	environmental-food
NC_002108	China	<2000	environmental
NC_002109	Maryland, USA	1961	clinical
NC_002110	Taiwan, china	<1998	clinical potential
NC_002111	Taiwan, China	1998	veterinary
NC_002112	New Mexico	1959	environmental-soil
NC_002113	Ehime, Japan	<1998	environmental-wastewaters
NC_002114	Ehime, Japan	<1998	environmental-wastewaters
NC_002115	ND	1958	environmental-soil
NC_002117	Germany	1982	veterinary

NC_002118	Hamilton, USA	1935	veterinary
NC_002119	Utrecht, The Netherlands	<1963	clinical
NC_002120	Brussels, Belgium	1971	clinical
NC_002122	ND	<1986	ND
NC_002123	Philippines	<1999	environmental-food
NC_002126	Michigan, USA	1953	environmental-food
NC_002127	Sakai, Japan	1996	clinical
NC_002128	Sakai, Japan	1996	clinical
NC_002129	United Kingdom	<1967	clinical
NC_002130	Taiwan	<1998	veterinary
NC_002131	Russia	<1993	clinical
NC_002132	Kyoto, Japan	<1998	veterinary
NC_002133	UK	<1998	environmental-human
NC_002134	Aichi Prefecture, Japan	2003	clinical
NC_002136	Paris, France	1975	clinical
NC_002137	The Netherlands	1984	environmental-food
NC_002138	Ireland	1994	environmental-food
NC_002139	ND	<1998	environmental-animal
NC_002140	Japan	<1998	veterinary
NC_002141	ND	<1999	environmental
NC_002142	Seattle, USA	1980	clinical
NC_002143	Leeds, UK	1956	environmental-wastewaters
NC_002144	Ban Na, Menghai county, China	1990	clinical potential
NC_002145	Czech Republic	1989	clinical
NC_002146	ND	1930	clinical
NC_002147	Japan	<1997	environmental-plant and algae
NC_002148	ND	<1997	ND
NC_002149	South Africa	<1999	environmental-food
NC_002150	Ireland	<1999	environmental-food
NC_002175	ND	<2000	environmental-marine
NC_002182	Rockville, USA	1977	veterinary
NC_002191	Italy	<2000	environmental-food
NC_002192	The Netherlands	<1982	environmental-food
NC_002193	The Netherlands	<1982	environmental-food
NC_002252	Tokyo, Japan	1998	environmental-animal
NC_002253	Tokyo, Japan	1998	environmental-animal
NC_002305	United Kingdom	1961	clinical
NC_002377	ND	<1998	environmental-plant and algae
NC_002473	Kansai Airport Quarantine Station, Osaka, Japan.	1996	clinical
NC_002483	California, USA	1922	clinical
NC_002487	Brazil	1970	environmental-human
NC_002489	Brazil	1987	environmental-plant and algae
NC_002490	Brazil	1987	environmental-plant and algae
NC_002497	USA	1988	veterinary
NC_002498	USA	1988	veterinary
NC_002502	Ireland	<1993	environmental-food
NC_002517	ND	<1999	clinical
NC_002518	Germany	1985	environmental-wastewaters
NC_002522	Australia	<2000	environmental-food
NC_002523	New Zealand	<1999	veterinary
NC_002524	Germany	<2000	environmental-animal
NC_002525	California, USA	1922	clinical
NC_002569	Australia	2001	veterinary
NC_002575	Japan	<2000	environmental-plant and algae
NC_002576	ND	<1981	veterinary
NC_002579	USA	<2000	clinical
NC_002580	Milan, Italy	1995	environmental-food
NC_002610	Coventry, United Kingdom	1977/82	clinical
NC_002611	USA	<1997	environmental-food
NC_002630	USA	<2000	clinical
NC_002632	ND	1933	environmental-human
NC_002635	Korea	<1999	environmental-human
NC_002636	Australia	<1999	veterinary
NC_002637	Germany	<1999	veterinary
NC_002638	Japan	<1992	veterinary

NC_002650	Canada	<1998	clinical
NC_002664	Hungary	<2000	veterinary
NC_002675	Japan	2000	environmental-wastewaters
NC_002679	Japan	<2000	environmental-plant and algae
NC_002682	Japan	<2000	environmental-plant and algae
NC_002698	USA	<1990	clinical
NC_002699	USA	<2001	environmental-plant and algae
NC_002748	Canada	<2000	environmental-food
NC_002757	Birmingham, Alabama, USA	<1998	clinical
NC_002759	UK	1965	environmental-plant and algae
NC_002760	Germany	<2001	clinical
NC_002773	Tokyo, Japan	1954	clinical
NC_002774	Japan	1996	clinical
NC_002775	ND	<2001	clinical
NC_002776	ND	<2001	environmental-food
NC_002798	ND	<1994	environmental-food
NC_002799	ND	<2001	environmental-food
NC_002806	California, USA	<2001	environmental-marine
NC_002809	ND	<2000	clinical
NC_002810	ND	<1998	clinical
NC_003037	ND	<2001	environmental-soil
NC_003042	ND	<2002	clinical
NC_003064	New York, USA	<2001	environmental-plant and algae
NC_003065	New York, USA	<2001	environmental-plant and algae
NC_003078	New South Wales, Australia	1939	environmental-soil
NC_003079	China	<2001	clinical
NC_003080	ND	<2001	clinical
NC_003091	ND	<2000	clinical
NC_003099	Ribeira Sacra, Spain	<2001	environmental-food
NC_003101	ND	<2001	environmental-food
NC_003114	Yale University, Connecticut, USA	1972	veterinary
NC_003123	Noruega	<2001	veterinary
NC_003124	Noruega	<2001	veterinary
NC_003125	Taiwan	1985/93	veterinary
NC_003131	ND	<1999	clinical
NC_003132	ND	<1999	clinical
NC_003134	ND	<1999	clinical
NC_003140	ND	1982	clinical
NC_003201	Ribeira Sacra, Spain	<2001	environmental-food
NC_003227	ND	<2001	environmental-soil
NC_003239	ND	<2002	clinical
NC_003240	ND	<2001	environmental-freshwater
NC_003241	ND	<2001	environmental-freshwater
NC_003265	ND	<2000	clinical
NC_003267	ND	<2001	environmental-freshwater
NC_003270	ND	<2001	environmental-freshwater
NC_003273	ND	<2001	environmental-freshwater
NC_003276	ND	<2001	environmental-freshwater
NC_003277	ND	1948	ND
NC_003292	United Kingdom	1966	clinical
NC_003296	ND	<2002	environmental-plant and algae
NC_003319	Aberdeen, UK	1948	environmental-plant and algae
NC_003320	Argentina	<1999	environmental-food
NC_003350	UK	<2001	ND
NC_003353	Japan	<2001	environmental-plant and algae
NC_003374	ND	<2002	ND
NC_003383	Morocco	1988	clinical
NC_003384	Vietnam	1993	clinical
NC_003385	Vietnam	1993	clinical
NC_003411	Lower Saxony, Germany	<2001	veterinary
NC_003425	ND	<2001	environmental-animal
NC_003442	ND	<2002	clinical
NC_003455	ND	<2003	environmental
NC_003456	ND	<2003	environmental
NC_003457	Czech Republic	<1950	environmental

NC_003458	ND	<2002	environmental-food
NC_003486	ND	<2002	clinical
NC_003490	ND	<2002	clinical
NC_003526	ND	<2002	clinical
NC_003527	ND	<2001	environmental-human
NC_003528	ND	<2002	environmental
NC_003789	ND	<2001	environmental-marine
NC_003846	ND	<1997	environmental
NC_003892	Oxfordshire, UK	<2001	environmental-plant and algae
NC_003893	ND	<2002	environmental-food
NC_003894	ND	<2002	environmental-food
NC_003903	ND	<2001	environmental-soil
NC_003904	ND	<2001	environmental-soil
NC_003905	ND	<2001	clinical
NC_003921	ND	<2001	environmental-plant and algae
NC_003922	ND	<2001	environmental-plant and algae
NC_003969	Segunda region, Chile	<2002	environmental-freshwater
NC_004041	ND	<1996	environmental-soil
NC_004058	Fartura, Brazil	1980	clinical
NC_004059	ND	<2002	clinical
NC_004073	ND	<2001	environmental-freshwater
NC_004160	ND	<2002	environmental-soil
NC_004163	ND	<2002	environmental-food
NC_004164	ND	<2002	environmental-food
NC_004252	ND	<2002	environmental-human
NC_004253	ND	<2002	environmental-human
NC_004308	ND	<2002	clinical
NC_004319	Kanagawa, Japan	<2002	environmental-soil
NC_004320	Kanagawa, Japan	<2002	environmental-soil
NC_004334	Israel	1975	environmental-soil
NC_004335	ND	<2002	ND
NC_004338	Switzerland	<2002	veterinary
NC_004339	Switzerland	<2002	veterinary
NC_004340	Switzerland	<2002	veterinary
NC_004341	ND	<2002	environmental-food
NC_004345	ND	<2002	veterinary
NC_004349	Oneida Lake, New York, USA	1987	environmental-freshwater
NC_004429	ND	<2002	environmental-human
NC_004443	ND	<2001	environmental-human
NC_004444	Japan	2003	environmental-wastewaters
NC_004445	Korea	<2002	environmental-plant and algae
NC_004446	Illinois, USA	<2002	environmental-plant and algae
NC_004457	ND	<2001	environmental-food
NC_004458	Wakayama or Shiga, Japan	<1942	environmental
NC_004464	Warsaw, Poland	1996	clinical
NC_004526	Leeds, United Kingdom	<2002	clinical
NC_004527	Kyoto, Soraku, Kizu, Japan	<2002	environmental
NC_004528	ND	<2002	environmental-food
NC_004532	ND	<1999	environmental
NC_004533	Japan	<1984	environmental-soil
NC_004534	Japan	<1981	environmental-soil
NC_004535	Québec, Canada	1987	environmental-wastewaters
NC_004554	California, USA	1998	environmental-plant and algae
NC_004555	ND	<2002	environmental-plant and algae
NC_004562	Eastern Norway, Norway	<2002	veterinary
NC_004564	Japan	<2002	clinical
NC_004565	ND	<2002	clinical
NC_004566	Switzerland	<2002	environmental-food
NC_004574	San Diego, California, USA	<2001	environmental-marine
NC_004604	ND	1967	ND
NC_004632	Guernsey, UK	1960	environmental-plant and algae
NC_004633	Guernsey, UK	1960	environmental-plant and algae
NC_004652	Belgrade, Serbia	<2003	environmental-food
NC_004653	Belgrade, Serbia	<2003	environmental-food
NC_004669	USA	<2003	environmental-human

NC_004670	USA	<2003	environmental-human
NC_004671	USA	<2003	environmental-human
NC_004703	ND	<2002	environmental-human
NC_004704	ND	1935	clinical potential
NC_004719	ND	<2002	environmental-soil
NC_004720	ND	<2002	clinical potential
NC_004721	ND	<2003	clinical
NC_004734	ND	<2000	environmental
NC_004747	ND	<2003	environmental-food
NC_004758	Norway	<2000	clinical
NC_004767	ND	<2003	clinical
NC_004768	ND	<2002	environmental-human
NC_004769	ND	<2002	environmental-human
NC_004770	ND	<2002	environmental-human
NC_004771	ND	<2003	veterinary
NC_004772	ND	<2003	veterinary
NC_004773	ND	<2003	clinical
NC_004774	ND	<2003	environmental-human
NC_004808	ND	<2002	environmental-soil
NC_004811	ND	<2003	veterinary
NC_004822	ND	<2003	environmental-plant and algae
NC_004832	ND	<1993	environmental-food
NC_004833	ND	<1996	environmental
NC_004834	Japan	<2003	environmental-plant and algae
NC_004835	ND	<1998	clinical potential
NC_004836	ND	<1998	clinical potential
NC_004837	ND	<1998	clinical potential
NC_004838	ND	<1998	clinical potential
NC_004839	ND	<1993	clinical potential
NC_004843	Valencia, Spain	<2000	environmental-animal
NC_004845	ND	<2000	clinical
NC_004846	Brazil	<2001	clinical
NC_004847	ND	<2000	environmental-food
NC_004849	ND	<2001	environmental-food
NC_004850	ND	<2001	environmental-food
NC_004851	Changping District, Beijing, China	1984	clinical
NC_004854	Ontario, Canada	<2000	veterinary
NC_004900	ND	<2003	environmental-soil
NC_004922	ND	<1998	environmental-food
NC_004923	Eure river, France	1975	veterinary
NC_004924	Eure river, France	1975	veterinary
NC_004925	Eure river, France	1975	veterinary
NC_004929	San Diego, California, USA	<2001	environmental-marine
NC_004930	ND	<2001	environmental-food
NC_004931	South Australia	<2002	environmental-plant and algae
NC_004932	ND	<1974	ND
NC_004933	ND	<2001	environmental-soil
NC_004934	Kanagawa, Japan	1974	environmental-soil
NC_004936	ND	<2002	ND
NC_004937	ND	<1998	environmental-food
NC_004938	ND	<1994	environmental-soil
NC_004939	Japan	1979/80	clinical
NC_004940	Louisiana, USA	<2002	environmental-plant and algae
NC_004941	ND	<2002	environmental
NC_004942	ND	<2001	environmental-food
NC_004943	ND	<2002	environmental-human
NC_004944	Wisconsin, USA	1994	environmental-food
NC_004945	ND	<1999	ND
NC_004947	ND	<2001	environmental-human
NC_004949	Germany	<2002	clinical
NC_004950	Germany	<2002	clinical
NC_004951	Aichi, Japan	<2002	environmental-soil
NC_004952	California, USA	1984	clinical
NC_004953	ND	1994	clinical
NC_004954	San Diego, California, USA	<2001	environmental-marine

NC_004955	ND	<2000	environmental-food
NC_004956	USA	<1996	environmental-soil
NC_004957	ND	<2000	environmental-animal
NC_004958	ND	<2000	environmental-food
NC_004959	ND	<1997	environmental-food
NC_004960	ND	<1995	environmental-food
NC_004961	ND	1998	environmental-marine
NC_004962	Scotland	<1999	environmental-animal
NC_004963	ND	<1998	clinical potential
NC_004964	California, USA	<2014	environmental-freshwater
NC_004965	ND	<2000	environmental-soil
NC_004966	ND	<2000	environmental-food
NC_004968	ND	<1997	environmental-food
NC_004969	ND	<1999	environmental
NC_004971	North America	<1999	clinical
NC_004972	ND	<1999	environmental-soil
NC_004974	Los Angeles, California, USA	<1999	clinical
NC_004977	ND	<1997	environmental-animal
NC_004978	ND	<1996	environmental-human
NC_004979	ND	<1995	ND
NC_004980	ND	<1996	environmental-food
NC_004981	ND	<1997	environmental-food
NC_004982	India	1964	clinical
NC_004984	ND	<1997	environmental
NC_004985	ND	<1996	environmental-food
NC_004986	ND	<1997	environmental-animal
NC_004987	ND	<1996	environmental-plant and algae
NC_004988	New York, USA	<1995	clinical potential
NC_004989	USA	1969	clinical
NC_004990	ND	<1992	environmental-freshwater
NC_004991	ND	<1954	environmental
NC_004992	ND	<1994	environmental-food
NC_004997	ND	<2003	clinical
NC_004998	Warsaw, Poland	1997	clinical
NC_004999	ND	<1993	environmental-soil
NC_005000	Ohio, USA	<1998	clinical
NC_005001	Seattle, USA	<2002	clinical
NC_005002	ND	<2003	clinical
NC_005003	ND	<2002	environmental-food
NC_005004	ND	<2002	environmental-food
NC_005005	ND	<2002	environmental-food
NC_005006	ND	<2002	environmental-food
NC_005007	ND	<2002	environmental-food
NC_005008	ND	<2002	environmental-food
NC_005009	ND	<2000	environmental
NC_005010	Gottingen	<1999	environmental-animal
NC_005011	North Dakota, USA	1998	clinical
NC_005012	Minnesota, USA	1981	clinical
NC_005013	ND	<2002	clinical
NC_005014	ND	<2003	clinical
NC_005015	Ho Chi Minh City, Vietnam	1996	clinical
NC_005016	ND	<2001	clinical
NC_005017	USA	<2001	clinical
NC_005018	ND	<2000	clinical
NC_005019	Russia	<2000	ND
NC_005020	Saskatchewan, Canada	<1999	veterinary
NC_005021	Siena, Italy	1980	clinical
NC_005022	New York, USA	1916	clinical
NC_005023	Japan	1972	environmental-soil
NC_005024	ND	1975	clinical
NC_005026	ND	<1995	environmental-human
NC_005054	Michigan, USA	2002	clinical
NC_005073	Gottingen, Germany	1994	environmental-soil
NC_005076	Bavaria, Germany	<2003	veterinary
NC_005088	Osaka, Japan	<2001	environmental-wastewaters

NC_005098	Bulgaria	<2003	environmental-food
NC_005127	ND	<2002	clinical
NC_005128	Taiwan	<2002	clinical
NC_005205	Oklahoma, USA	<2003	environmental-plant and algae
NC_005206	ND	<2003	veterinary
NC_005207	ND	<2003	environmental-food
NC_005208	ND	<2003	environmental-food
NC_005211	USA	1969	clinical
NC_005229	ND	1968	environmental-freshwater
NC_005230	ND	1968	environmental-freshwater
NC_005231	ND	1968	environmental-freshwater
NC_005232	ND	1968	environmental-freshwater
NC_005240	South America	<2003	environmental-plant and algae
NC_005241	ND	<2003	environmental-soil
NC_005242	Singapore	<2003	environmental-freshwater
NC_005243	Paris, France	<2001	clinical
NC_005244	Tianjin, China	<2003	environmental-wastewaters
NC_005245	Taiwan	<2003	veterinary
NC_005246	Lebanon	<2003	environmental-plant and algae
NC_005247	Utah, USA	<2003	environmental-plant and algae
NC_005248	ND	<2003	clinical
NC_005249	ND	<2003	clinical
NC_005250	Washington, USA	<1993	veterinary
NC_005297	ND	<2003	environmental
NC_005307	Westfalia, Germany	<2003	environmental-freshwater
NC_005308	Italy	<2003	environmental-soil
NC_005311	Italy	<2003	environmental-soil
NC_005312	Japan	<2003	veterinary
NC_005322	ND	<2003	environmental-food
NC_005323	ND	<2003	environmental-food
NC_005324	East London, United Kingdom	<2003	clinical
NC_005325	The Netherlands	<2002	clinical
NC_005326	ND	<2002	clinical
NC_005327	Toronto, Canada	2000/2	clinical
NC_005328	Minnesota, USA	<2003	environmental-soil
NC_005329	ND	<2000	clinical
NC_005564	ND	<1988	clinical
NC_005565	Uppsala, Sweden	<2004	clinical
NC_005566	Australia	1982	clinical
NC_005567	ND	<1988	environmental
NC_005570	ND	<1999	veterinary
NC_005701	ND	<1998	ND
NC_005702	ND	<2000	environmental-food
NC_005703	Italy, Roma	<1999	environmental-soil
NC_005704	Italy, Roma	<1999	environmental-soil
NC_005705	Switzerland	<1999	environmental-food
NC_005706	USA	<2000	environmental-plant and algae
NC_005707	Canada	1930	environmental-food
NC_005792	Mine, Shizuoka Prefecture, Japan	1968	environmental-freshwater
NC_005793	Estonia	<2004	environmental-soil
NC_005813	China	<2003	clinical potential
NC_005814	China	<2003	clinical potential
NC_005815	China	<2003	clinical potential
NC_005816	China	<2003	clinical potential
NC_005838	Japan	<2004	environmental-freshwater
NC_005862	ND	<2001	clinical
NC_005863	Hildenborough, Kent, UK	1946	environmental-soil
NC_005871	Sulu Sea, philipines	1986	environmental-animal
NC_005908	ND	<1993	ND
NC_005909	ND	<1997	environmental
NC_005910	Australia	<2003	environmental-animal
NC_005911	Australia	<2003	environmental-animal
NC_005913	Buena Vista, Kern County, California, USA	1983	environmental-animal
NC_005914	Buena Vista, Kern County, California, USA	1983	environmental-animal
NC_005915	ND	<2003	environmental-freshwater

NC_005917	ND	<2004	clinical
NC_005918	ND	<2004	environmental-plant and algae
NC_005919	ND	<2004	environmental-plant and algae
NC_005920	ND	<2004	environmental-plant and algae
NC_005921	ND	<2004	environmental-plant and algae
NC_005922	ND	<2004	environmental-plant and algae
NC_005923	ND	<2004	ND
NC_005951	ND	1998	clinical
NC_005952	Japan	<2003	environmental-food
NC_005970	New Jersey, USA	1943	environmental-soil
NC_006128	ND	<2004	clinical
NC_006129	ND	<2004	clinical
NC_006130	USA	1970/75	clinical
NC_006134	United Kingdom	<2003	clinical
NC_006135	ND	<2003	clinical
NC_006139	Svalbard, Norway	<2004	environmental-soil
NC_006140	Svalbard, Norway	<2004	environmental-soil
NC_006143	Kendal, UK	1997	environmental-wastewaters
NC_006145	ND	<1997	environmental-food
NC_006153	France	<2004	clinical
NC_006154	France	<2004	clinical
NC_006257	ND	<2003	environmental-human
NC_006258	Braunschweig, Germany	1979	environmental-soil
NC_006277	Australia	1972	environmental-soil
NC_006278	ND	<2004	environmental-food
NC_006297	Japan	<2004	clinical
NC_006298	ND	1999	veterinary
NC_006323	Georgia, USA	<2004	clinical potential
NC_006362	ND	<2003	clinical
NC_006363	ND	<2003	clinical
NC_006365	France	<2004	clinical
NC_006366	France	<2004	clinical
NC_006374	France	<2001	veterinary
NC_006375	ND	<2004	environmental-human
NC_006376	ND	<2004	environmental-human
NC_006377	ND	<2004	environmental-human
NC_006399	ND	<2004	environmental-food
NC_006400	USA	<2004	environmental-plant and algae
NC_006427	ND	<2004	clinical
NC_006462	Japan	<2004	environmental-freshwater
NC_006463	Japan	<2004	environmental-freshwater
NC_006466	ND	<1993	environmental-soil
NC_006509	ND	<2003	environmental-marine
NC_006525	Belgium	1976	environmental-wastewaters
NC_006528	Japan	<2004	environmental-soil
NC_006529	ND	<2002	environmental-human
NC_006530	ND	<2002	environmental-human
NC_006569	Georgia	1999	environmental-marine
NC_006571	Kansai, Japan	1970/79	environmental-soil
NC_006578	ND	<2004	clinical
NC_006625	ND	<2004	clinical
NC_006628	Hong Kong	<2004	clinical
NC_006629	United Kingdom	1960	clinical
NC_006663	Tennessee, USA	1979/80	clinical
NC_006671	ND	<2003	veterinary
NC_006672	ND	<1967	environmental-plant and algae
NC_006673	ND	<1967	environmental-plant and algae
NC_006674	ND	<1967	environmental-plant and algae
NC_006675	ND	<1967	environmental-plant and algae
NC_006676	ND	<1967	environmental-plant and algae
NC_006815	ND	<2003	clinical
NC_006816	ND	<2003	clinical
NC_006821	Argentina	1999	environmental-plant and algae
NC_006822	ND	<2004	environmental-food
NC_006823	ND	<2004	environmental

NC_006824	ND	<2004	environmental
NC_006825	China	<2004	ND
NC_006826	ND	<2004	environmental
NC_006827	ND	<1995	clinical
NC_006828	Victoria, Australia	<2004	veterinary
NC_006829	Victoria, Australia	<2004	veterinary
NC_006830	Czech Republic	<2002	environmental-soil
NC_006842	Kane'ohe Bay, O'ahu, Hawaii, USA	1988	environmental-animal
NC_006843	ND	2004	environmental-human
NC_006855	ND	2002	clinical
NC_006856	ND	2002	clinical
NC_006857	ND	<2004	environmental-animal
NC_006860	San Diego, California, USA	2000	environmental-marine
NC_006868	Belgium	<2005	veterinary
NC_006869	Italy,Roma	<2004	environmental-soil
NC_006870	Italy,Roma	<2004	environmental-soil
NC_006871	Poland	<2005	environmental-animal
NC_006872	ND	<2004	clinical
NC_006873	ND	1955	clinical
NC_006877	ND	<2004	clinical
NC_006881	Slovenia	2001/2	clinical
NC_006903	Japan	<2002	environmental-plant and algae
NC_006904	Hokkaido, Japan	<2005	environmental-food
NC_006907	Romania	1993	environmental-soil
NC_006909	Romania	1992	environmental-soil
NC_006910	Texas, USA	1972	environmental-soil
NC_006911	China	<2005	environmental-soil
NC_006912	China	<2005	environmental-soil
NC_006959	Paris, France	<2004	environmental-soil
NC_006968	The Netherlands	<2004	environmental-human
NC_006969	ND	<2005	environmental-soil
NC_006970	ND	<2005	environmental-soil
NC_006974	ND	<1998	environmental-food
NC_006975	USA	<2005	environmental-animal
NC_006976	Belgium	<2005	veterinary
NC_006977	ND	1970s	ND
NC_006978	ND	<1992	ND
NC_006979	ND	<1992	ND
NC_006988	ND	<2005	environmental
NC_006989	ND	<2005	environmental
NC_006994	North Yorkshire, UK	<2005	veterinary
NC_006997	ND	<2003	environmental-human
NC_007068	ND	<2005	environmental-human
NC_007093	ND	<2004	clinical
NC_007094	Switzerland	<2004	veterinary
NC_007095	Switzerland	<2004	veterinary
NC_007096	Switzerland	<2004	veterinary
NC_007097	Switzerland	<2004	veterinary
NC_007098	Switzerland	<2004	veterinary
NC_007099	Switzerland	<2004	veterinary
NC_007100	Frankfurt, Germany	<2005	clinical
NC_007101	Illinois, USA	<2005	environmental-plant and algae
NC_007103	ND	<2004	veterinary
NC_007104	ND	<2004	veterinary
NC_007105	ND	<2004	veterinary
NC_007106	ND	<2004	veterinary
NC_007107	ND	<2004	veterinary
NC_007110	ND	1990	clinical potential
NC_007111	ND	1990	clinical potential
NC_007141	ND	1985	clinical
NC_007142	ND	<2005	clinical potential
NC_007143	ND	<2005	clinical potential
NC_007165	Norway	<2005	veterinary
NC_007166	Norway	<2005	veterinary
NC_007167	Norway	<2005	environmental-food

NC_007169	Japan	2000	clinical
NC_007170	Japan	2000	clinical
NC_007171	Japan	2000	clinical
NC_007182	ND	<2004	environmental-animal
NC_007183	ND	<2004	environmental-animal
NC_007184	ND	<2004	environmental-animal
NC_007185	ND	<2004	environmental-animal
NC_007186	ND	<2004	environmental-animal
NC_007187	ND	<2004	environmental-animal
NC_007190	ND	<2005	environmental
NC_007191	ND	<2005	environmental-food
NC_007202	Quebec, Canada	1990s	environmental-soil
NC_007203	China	<2002	environmental
NC_007206	Brazil	<2004	clinical
NC_007207	ND	<2004	environmental-food
NC_007208	ND	<2003	clinical
NC_007209	Australia	<2005	clinical
NC_007274	Ethiopia	1985	environmental-plant and algae
NC_007275	Ethiopia	1985	environmental-plant and algae
NC_007293	Czech Republic	<2005	environmental-food
NC_007322	Sarita, Texas, USA	1981	veterinary
NC_007323	Sarita, Texas, USA	1981	veterinary
NC_007336	ND	<2005	ND
NC_007337	ND	<2005	ND
NC_007351	Japan	<2005	clinical
NC_007352	Japan	<2005	clinical
NC_007353	ND	<2005	environmental-soil
NC_007365	Australia	<2001	clinical
NC_007385	China	1950	clinical
NC_007386	Morocco	1980	environmental-animal
NC_007387	Morocco	<2005	environmental-animal
NC_007388	Morocco	<2005	environmental-animal
NC_007389	Morocco	<2005	environmental-animal
NC_007390	Morocco	<2005	environmental-animal
NC_007391	Morocco	<2005	environmental-animal
NC_007392	Morocco	<2005	environmental-animal
NC_007414	ND	<1998	clinical
NC_007430	ND	<2005	clinical
NC_007431	ND	1984	environmental-soil
NC_007483	North Atlantic	<2005	environmental-marine
NC_007486	ND	<2005	environmental-marine
NC_007487	ND	<2005	environmental-marine
NC_007488	ND	2001	ND
NC_007489	ND	2001	ND
NC_007490	ND	2001	ND
NC_007491	ND	<2005	environmental-marine
NC_007504	ND	<2005	environmental-plant and algae
NC_007505	ND	<2005	environmental-plant and algae
NC_007506	ND	<2005	environmental-plant and algae
NC_007507	ND	<2005	environmental-plant and algae
NC_007515	Maryland, USA	<2005	environmental-freshwater
NC_007593	ND	<1999	environmental-food
NC_007594	Japan	1998	clinical
NC_007595	ND	<2005	environmental-freshwater
NC_007607	China	1950	clinical
NC_007608	China	1950	clinical
NC_007615	Paramaribo, Surinam	<2005	environmental-soil
NC_007616	Paramaribo, Surinam	<2005	environmental-soil
NC_007617	Paramaribo, Surinam	<2005	environmental-soil
NC_007621	Poland	<2005	veterinary
NC_007635	ND	<2005	clinical
NC_007641	ND	1971	ND
NC_007675	ND	<2004	veterinary
NC_007678	ND	<2005	environmental-marine
NC_007682	ND	<2004	veterinary

NC_007706	ND	<2003	environmental
NC_007713	ND	<2004	ND
NC_007714	ND	<2004	ND
NC_007715	ND	<2004	ND
NC_007717	Celeryville, Ohio, USA	<2005	environmental-plant and algae
NC_007718	Celeryville, Ohio, USA	<2005	environmental-plant and algae
NC_007719	Celeryville, Ohio, USA	<2005	environmental-plant and algae
NC_007720	Celeryville, Ohio, USA	<2005	environmental-plant and algae
NC_007762	México	<2005	environmental-plant and algae
NC_007763	México	<2005	environmental-plant and algae
NC_007764	México	<2005	environmental-plant and algae
NC_007765	México	<2005	environmental-plant and algae
NC_007766	México	<2005	environmental-plant and algae
NC_007768	Germany	<2006	veterinary
NC_007769	Germany	<2006	veterinary
NC_007770	Germany	<2006	veterinary
NC_007771	Germany	<2006	veterinary
NC_007772	Europe	1990/99	clinical
NC_007773	Europe	1990/99	clinical
NC_007790	San Francisco General Hospital, USA	<2006	clinical
NC_007791	San Francisco General Hospital, USA	<2006	clinical
NC_007792	San Francisco General Hospital, USA	<2006	clinical
NC_007800	France	<2006	veterinary
NC_007801	Bodega Head, California, USA	2003	environmental-marine
NC_007900	Japan	<2004	veterinary
NC_007901	Virginia, USA	<2006	environmental-freshwater
NC_007926	USA	<2005	clinical
NC_007927	China	<2005	environmental
NC_007928	Tokyo, Japan	<2006	clinical
NC_007930	ND	<2005	clinical
NC_007931	Tokyo, Japan	<2006	clinical
NC_007941	ND	<2006	clinical
NC_007949	ND	<2006	ND
NC_007950	ND	<2006	ND
NC_007956	Japan	1970/5	environmental-food
NC_007959	Hamburg, Germany	<2006	environmental-soil
NC_007960	Hamburg, Germany	<2006	environmental-soil
NC_007961	Hamburg, Germany	<2006	environmental-soil
NC_007962	Northern Ireland	<2006	clinical potential
NC_007968	Kolyma lowland, Siberia, Russia	2006	environmental-marine
NC_007971	Belgium	1976	environmental-wastewaters
NC_007972	ND	1976	environmental-wastewaters
NC_007974	ND	1976	environmental-wastewaters
NC_008010	Termi di Agnano, italy	<2006	environmental-freshwater
NC_008012	USA	<2005	veterinary
NC_008013	USA	<2005	veterinary
NC_008014	USA	<2005	veterinary
NC_008036	Alaska, USA	<2006	environmental-marine
NC_008042	ND	2000	environmental-marine
NC_008043	ND	2000	environmental-marine
NC_008049	ND	1998	clinical
NC_008050	ND	1998	clinical
NC_008051	ND	1998	clinical
NC_008052	ND	<2006	clinical
NC_008053	Austria	<2005	environmental-plant and algae
NC_008087	Sweden	<2005	clinical
NC_008118	Nepal	<2006	clinical
NC_008119	Nepal	<2006	clinical
NC_008120	Africa	1965	clinical
NC_008121	Africa	1965	clinical
NC_008122	Africa	1965	clinical
NC_008147	ND	<2006	ND
NC_008226	Zurich, Switzerland	1982	clinical
NC_008230	ND	<2006	veterinary
NC_008242	ND	<2006	ND

NC_008243	ND	<2006	ND
NC_008244	ND	<2006	ND
NC_008246	Japan	<2006	clinical
NC_008247	ND	<2006	clinical
NC_008259	Spain	<2006	environmental-food
NC_008269	ND	<2006	environmental-soil
NC_008270	ND	<2006	environmental-soil
NC_008271	ND	<2006	environmental
NC_008273	ND	<2006	clinical potential
NC_008274	ND	<2006	clinical potential
NC_008275	ND	<1985	environmental-soil
NC_008308	ND	<2002	environmental-wastewaters
NC_008320	Oneida Lake, New York, USA	<2006	environmental-freshwater
NC_008341	USA	<2006	environmental-wastewaters
NC_008342	USA	<2006	environmental-wastewaters
NC_008350	Poland	<2006	clinical
NC_008351	Germany	2003/5	veterinary
NC_008352	Germany	2003/5	veterinary
NC_008353	Germany	2003/5	veterinary
NC_008354	Germany	2003/5	veterinary
NC_008356	Germany	2003/5	veterinary
NC_008357	Moscow	1981/1982	environmental-wastewaters
NC_008378	ND	<2006	environmental-plant and algae
NC_008379	ND	<2006	environmental-plant and algae
NC_008381	ND	<2006	environmental-plant and algae
NC_008382	ND	<2006	environmental-plant and algae
NC_008383	ND	<2006	environmental-plant and algae
NC_008384	ND	<2006	environmental-plant and algae
NC_008385	ND	<2006	ND
NC_008386	ND	<2006	environmental-marine
NC_008387	ND	<2006	environmental-marine
NC_008388	ND	<2006	environmental-marine
NC_008389	ND	<2006	environmental-marine
NC_008436	ND	<1996	environmental-food
NC_008438	ND	<2000	veterinary
NC_008439	Gyeongbuk Province, South Korea	1998	clinical
NC_008440	ND	<2002	environmental-freshwater
NC_008441	ND	<2002	environmental-soil
NC_008442	Tanzania	<2001	clinical
NC_008443	Leningrad province, Russia	<1993	clinical potential
NC_008444	USA	1955	clinical
NC_008445	Europe	<1995	environmental-food
NC_008459	Oita, Japan	<2005	clinical
NC_008460	Japan	<2006	clinical
NC_008486	ND	<2006	clinical
NC_008487	ND	<2006	clinical
NC_008488	ND	<2006	clinical
NC_008489	ND	<2006	clinical
NC_008490	ND	<2006	clinical
NC_008496	ND	<2006	environmental-food
NC_008498	ND	<2006	environmental-food
NC_008499	ND	<2006	environmental-food
NC_008500	ND	<2006	environmental-food
NC_008501	ND	<2006	environmental-food
NC_008502	ND	<2006	environmental-food
NC_008503	ND	<2006	environmental-food
NC_008504	ND	<2006	environmental-food
NC_008505	ND	<2006	environmental-food
NC_008506	ND	<2006	environmental-food
NC_008507	ND	<2006	environmental-food
NC_008537	Indiana, USA	<2006	environmental-soil
NC_008538	Indiana, USA	<2006	environmental-soil
NC_008539	Indiana, USA	<2006	environmental-soil
NC_008545	ND	<2006	environmental-soil
NC_008564	ND	<2006	clinical

NC_008565	ND	<2006	clinical
NC_008566	ND	<2006	clinical
NC_008567	ND	<2006	clinical
NC_008568	ND	<2006	clinical
NC_008569	ND	<2006	clinical
NC_008573	ND	<2006	ND
NC_008594	ND	<2006	environmental-food
NC_008597	ND	<2006	environmental-animal
NC_008598	Iraq	<2006	environmental-soil
NC_008607	Germany	1984	environmental-freshwater
NC_008608	Germany	1984	environmental-freshwater
NC_008612	Japan	<2006	veterinary
NC_008613	USA	<2006	veterinary
NC_008688	ND	<2006	ND
NC_008690	Japan	2000	veterinary
NC_008691	Japan	<2006	environmental-wastewaters
NC_008697	ND	<2006	environmental-soil
NC_008703	ND	<2006	environmental-soil
NC_008704	ND	<2006	environmental-soil
NC_008712	South Dakota, USA	<2006	environmental-soil
NC_008713	South Dakota, USA	<2006	environmental-soil
NC_008738	Vietnam	1995	environmental
NC_008739	Vietnam	1995	environmental
NC_008741	ND	<2006	ND
NC_008757	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008758	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008759	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008760	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008761	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008762	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008763	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008764	South Glens Falls, New York, USA	<2006	environmental-soil
NC_008765	ND	<2006	ND
NC_008766	ND	<2006	ND
NC_008768	Norway	1999	clinical
NC_008770	ND	<2007	clinical
NC_008771	ND	<2006	ND
NC_008790	ND	<2007	clinical
NC_008791	Washington, USA	<2004	clinical
NC_008792	ND	<1994	environmental
NC_008821	Norway	1999	veterinary
NC_008823	Japan	<2006	environmental-soil
NC_008826	ND	<2007	environmental-wastewaters
NC_009007	ND	2001	ND
NC_009008	ND	2001	ND
NC_009034	ND	<2007	environmental-soil
NC_009035	ND	<2007	environmental-estuarine
NC_009036	ND	<2007	environmental-estuarine
NC_009037	ND	<2007	environmental-estuarine
NC_009038	ND	<2007	environmental-estuarine
NC_009040	ND	<2007	ND
NC_009128	ND	<2006	environmental-animal
NC_009129	ND	<2006	environmental-animal
NC_009130	ND	<2006	environmental-animal
NC_009131	ND	<2006	ND
NC_009132	ND	<2006	environmental-animal
NC_009133	Japan	1950	clinical
NC_009137	ND	<2005	environmental-food
NC_009139	ND	<2000	veterinary
NC_009140	Minnesota, USA	2000	clinical
NC_009141	Ambalavao district, Madagascar	1995	clinical
NC_009329	Northern China	<2007	environmental-soil
NC_009339	Indiana, USA	<2007	environmental-freshwater
NC_009340	Indiana, USA	<2007	environmental-freshwater
NC_009341	Indiana, USA	<2007	environmental-freshwater

NC_009343	Japan	<2005	environmental-soil
NC_009344	China	1950/59	clinical
NC_009345	China	1950/59	clinical
NC_009346	China	1950/59	clinical
NC_009347	China	1950/59	clinical
NC_009349	France	1975	veterinary
NC_009350	France	1975	veterinary
NC_009351	Galicia, Spain	<2007	veterinary
NC_009352	Portugal	<2006	veterinary
NC_009353	Mecklenburg-Vorpommern, Greifswald, Germany	<2007	environmental-freshwater
NC_009377	ND	<2007	clinical
NC_009378	ND	<2007	clinical
NC_009425	ND	<2007	environmental-plant and algae
NC_009426	Allendale, Michigan, USA	1989	environmental-marine
NC_009427	Allendale, Michigan, USA	1989	environmental-marine
NC_009429	ND	<2007	ND
NC_009430	ND	<2007	ND
NC_009431	ND	<2007	ND
NC_009432	ND	<2007	ND
NC_009433	ND	<2007	ND
NC_009435	ND	<2004	environmental-plant and algae
NC_009444	Oxfordshire, UK	<2006	environmental-plant and algae
NC_009453	ND	<2003	environmental-wastewaters
NC_009466	The Netherlands	1937	environmental-freshwater
NC_009467	ND	<2007	environmental-freshwater
NC_009468	ND	<2007	environmental-freshwater
NC_009469	ND	<2007	environmental-freshwater
NC_009470	ND	<2007	environmental-freshwater
NC_009471	ND	<2007	environmental-freshwater
NC_009472	ND	<2007	environmental-freshwater
NC_009473	ND	<2007	environmental-freshwater
NC_009474	ND	<2007	environmental-freshwater
NC_009475	North America	<2006	environmental-plant and algae
NC_009476	north Brittany, France	<2007	environmental-freshwater
NC_009477	ND	<2007	clinical
NC_009478	ND	<2007	environmental-plant and algae
NC_009479	ND	<2007	environmental-plant and algae
NC_009496	ND	1940	clinical
NC_009506	ND	<2006	clinical
NC_009507	Elbe River, Germany	<2007	environmental-freshwater
NC_009508	Elbe River, Germany	<2007	environmental-freshwater
NC_009516	Loíza, Puerto Rico	<2007	environmental-animal
NC_009517	Loíza, Puerto Rico	<2007	environmental-animal
NC_009595	Monterey County, California, USA	<2007	clinical potential
NC_009596	Monterey County, California, USA	<2007	clinical potential
NC_009602	Germany	1996	clinical
NC_009619	ND	<2007	clinical
NC_009620	Italy	1981	environmental-plant and algae
NC_009621	Italy	1981	environmental-plant and algae
NC_009622	Italy	1981	environmental-plant and algae
NC_009623	Switzerland	<2007	veterinary
NC_009624	Switzerland	<2007	veterinary
NC_009625	Switzerland	<2007	veterinary
NC_009649	ND	1994	clinical
NC_009650	ND	1994	clinical
NC_009651	ND	1994	clinical
NC_009652	ND	1994	clinical
NC_009653	ND	1994	clinical
NC_009660	South Carolina, USA	1999	environmental-wastewaters
NC_009661	Baltic sea	1986	environmental-marine
NC_009666	Beijing, China	<2007	environmental-food
NC_009669	ND	<2007	clinical potential
NC_009670	ND	<2007	clinical potential
NC_009671	ND	<2007	clinical potential
NC_009672	ND	<2007	clinical potential

NC_009673	France	<2007	clinical potential
NC_009700	ND	<2007	clinical
NC_009701	Spain	<2006	veterinary
NC_009702	Spain	<2006	veterinary
NC_009703	Spain	<2006	veterinary
NC_009704	Primorski, Slovenia	1966	clinical
NC_009705	Primorski, Slovenia	1966	clinical
NC_009713	ND	<2007	environmental-human
NC_009716	ND	<2007	environmental-soil
NC_009717	ND	<2007	environmental-soil
NC_009726	Dugway, USA	1957	veterinary
NC_009739	Texas, USA	<2007	clinical
NC_009751	ND	<1995	environmental-food
NC_009753	Russia	<2007	environmental-freshwater
NC_009777	ND	<2007	environmental-marine
NC_009779	ND	<2007	clinical potential
NC_009780	ND	<2007	clinical potential
NC_009781	ND	<2007	clinical
NC_009786	India	<2007	clinical potential
NC_009787	India	<2007	clinical potential
NC_009788	India	<2007	clinical potential
NC_009789	India	<2007	clinical potential
NC_009790	India	<2007	clinical potential
NC_009791	India	<2007	clinical potential
NC_009793	USA	1983	clinical
NC_009794	USA	1983	clinical
NC_009795	ND	<2007	environmental-human
NC_009796	ND	<2007	environmental-human
NC_009806	South Carolina, USA	1999	environmental-wastewaters
NC_009807	United Kingdom	<2005	clinical
NC_009829	ND	<2007	environmental-plant and algae
NC_009837	ND	<2006	veterinary
NC_009838	ND	<2006	veterinary
NC_009841	China	<2006	environmental-soil
NC_009897	France	1992	veterinary
NC_009926	Republic of Palau	<2007	environmental-animal
NC_009927	Republic of Palau	<2007	environmental-animal
NC_009928	Republic of Palau	<2007	environmental-animal
NC_009929	Republic of Palau	<2007	environmental-animal
NC_009930	Republic of Palau	<2007	environmental-animal
NC_009931	Republic of Palau	<2007	environmental-animal
NC_009932	Republic of Palau	<2007	environmental-animal
NC_009933	Republic of Palau	<2007	environmental-animal
NC_009934	Republic of Palau	<2007	environmental-animal
NC_009939	ND	<2007	environmental-freshwater
NC_009955	Bay of Tokyo, Japan	<2007	environmental-marine
NC_009956	Bay of Tokyo, Japan	<2007	environmental-marine
NC_009957	Bay of Tokyo, Japan	<2007	environmental-marine
NC_009958	Bay of Tokyo, Japan	<2007	environmental-marine
NC_009959	Bay of Tokyo, Japan	<2007	environmental-marine
NC_009966	ND	1979	clinical potential
NC_009980	ND	<2006	ND
NC_009981	ND	<2006	ND
NC_009982	ND	<2006	ND
NC_009998	Baltic sea	1986	environmental-marine
NC_009999	Baltic sea	1986	environmental-marine
NC_010000	Baltic sea	1986	environmental-marine
NC_010008	ND	1967	ND
NC_010009	ND	1967	ND
NC_010010	ND	1967	ND
NC_010021	ND	<1989	ND
NC_010029	ND	<1999	clinical
NC_010042	ND	<2003	veterinary
NC_010063	USA	<2007	clinical
NC_010064	ND	<1994	clinical

NC_010065	ND	<1998	environmental-food
NC_010066	USA	<2007	clinical
NC_010069	Spain	1997 /2001	veterinary
NC_010070	Berkeley, USA	<2007	environmental-soil
NC_010072	Madagascar	<1999	clinical
NC_010076	ND	<2002	environmental
NC_010077	ND	<2001	clinical
NC_010078	ND	<2002	environmental-food
NC_010096	California, USA	1975	clinical
NC_010097	Tama-graveyard, Tokyo, Japan	<1992	environmental-soil
NC_010098	ND	<1992	environmental-food
NC_010099	ND	<1991	environmental
NC_010111	Japan	<1969	clinical
NC_010112	Charleston, South Carolina, USA	1998	environmental-estuarine
NC_010113	Charleston, South Carolina, USA	1998	environmental-estuarine
NC_010114	Charleston, South Carolina, USA	1998	environmental-estuarine
NC_010115	Italy	1945	clinical
NC_010119	ND	<2007	clinical
NC_010123	Brazil	<2007	environmental-plant and algae
NC_010124	Brazil	<2007	environmental-plant and algae
NC_010157	ND	1984	clinical
NC_010158	ND	1984	clinical
NC_010160	ND	<2006	veterinary
NC_010164	ND	<2005	environmental-human
NC_010177	Belgium	<2007	environmental-food
NC_010180	Versailles, France	<2007	environmental-soil
NC_010181	Versailles, France	<2007	environmental-soil
NC_010182	Versailles, France	<2007	environmental-soil
NC_010183	Versailles, France	<2007	environmental-soil
NC_010230	ND	1971	ND
NC_010242	Karnal, India	<2005	environmental-food
NC_010243	ND	<1966	ND
NC_010257	ND	2006	environmental-human
NC_010259	Nevada, USA	2003	clinical
NC_010260	ND	<2005	clinical
NC_010261	Greece	2005	clinical
NC_010262	ND	<2007	clinical
NC_010279	Korea	<2007	clinical
NC_010281	Argentina	<2007	environmental-soil
NC_010282	Argentina	<2007	environmental-soil
NC_010283	Argentina	<2007	environmental-soil
NC_010284	ND	<2007	clinical
NC_010286	ND	2006	clinical
NC_010290	Korea	<2008	environmental-animal
NC_010291	Korea	<2008	environmental-animal
NC_010309	Italy	<2005	environmental-freshwater
NC_010310	Italy	<2005	environmental-freshwater
NC_010311	China	<2008	environmental-plant and algae
NC_010312	ND	<2007	environmental-food
NC_010330	UK	2002/3	veterinary
NC_010331	Utah, USA	<2007	environmental-freshwater
NC_010332	ND	<2007	environmental-plant and algae
NC_010333	ND	<2008	environmental-freshwater
NC_010335	ND	<2008	environmental-freshwater
NC_010370	Hong Kong	<2007	clinical
NC_010371	ND	<2005	clinical
NC_010372	China	<2007	ND
NC_010373	ND	<2008	ND
NC_010374	ND	<2008	ND
NC_010375	ND	<2007	environmental-food
NC_010377	Germany	<2007	clinical potential
NC_010378	ND	<2002	environmental-animal
NC_010379	USA	<2008	clinical potential
NC_010394	ND	<2007	clinical
NC_010399	Canada	<2008	environmental-plant and algae

NC_010401	France	2003	clinical
NC_010402	France	2003	clinical
NC_010403	France	2003	clinical
NC_010404	France	2003	clinical
NC_010405	China	<2007	environmental-plant and algae
NC_010406	China	<2007	environmental-plant and algae
NC_010408	Canada	<2008	environmental-plant and algae
NC_010409	ND	<2005	veterinary
NC_010418	Scotland	<2008	clinical potential
NC_010419	ND	<2007	clinical
NC_010420	Lithuania	<2007	environmental-soil
NC_010421	ND	<2003	veterinary
NC_010422	ND	<2005	veterinary
NC_010423	ND	<2007	clinical
NC_010426	ND	<2007	ND
NC_010427	ND	<2007	ND
NC_010428	ND	<2007	ND
NC_010429	ND	<2007	environmental-soil
NC_010464	ND	<2007	ND
NC_010466	ND	<2006	environmental-food
NC_010467	ND	<2006	environmental-food
NC_010469	ND	<2006	environmental-food
NC_010470	ND	<2006	environmental-food
NC_010474	Puerto Rico	1961	environmental-marine
NC_010476	Puerto Rico	1961	environmental-marine
NC_010477	Puerto Rico	1961	environmental-marine
NC_010478	Puerto Rico	1961	environmental-marine
NC_010479	Puerto Rico	1961	environmental-marine
NC_010480	Puerto Rico	1961	environmental-marine
NC_010481	Lebanon	2004/5	clinical
NC_010485	Shipyard Creek, South Carolina, USA	2005	environmental-estuarine
NC_010486	Shipyard Creek, South Carolina, USA	2005	environmental-estuarine
NC_010487	Shipyard Creek, South Carolina, USA	2005	environmental-estuarine
NC_010488	Shipyard Creek, South Carolina, USA	2005	environmental-estuarine
NC_010492	Marie, Michigan, USA	<2007	environmental-soil
NC_010494	Indiana, USA	<2007	environmental-soil
NC_010499	Asturias, Spain	<2007	clinical
NC_010500	Asturias, Spain	<2007	clinical
NC_010502	Japan	1995	environmental-food
NC_010504	Japan	1995	environmental-food
NC_010507	Japan	1995	environmental-food
NC_010509	Japan	1995	environmental-food
NC_010510	Japan	1995	environmental-food
NC_010514	Japan	1995	environmental-food
NC_010517	Japan	1995	environmental-food
NC_010518	Japan	1995	environmental-food
NC_010523	Japan	2006	environmental-food
NC_010529	Taiwan	<2008	environmental-plant and algae
NC_010539	ND	<2007	environmental-marine
NC_010540	Kagoshima, Japan	2000	environmental-marine
NC_010541	ND	<2007	environmental-marine
NC_010542	ND	<2007	environmental-marine
NC_010543	ND	<2007	environmental-marine
NC_010549	Siberia	<2006	environmental-soil
NC_010550	Siberia	<2006	environmental-soil
NC_010553	ND	<2008	ND
NC_010555	ND	<2008	clinical
NC_010558	Belgium	<2007	clinical
NC_010578	ND	<2008	ND
NC_010579	California, USA	2003	environmental-plant and algae
NC_010580	ND	<2008	ND
NC_010600	South Africa	<2008	environmental
NC_010603	ND	<2008	environmental-human
NC_010604	San Francisco, USA	1992	clinical
NC_010605	Rome, Italy	2005	clinical

NC_010606	Rome, Italy	2005	clinical
NC_010607	Arabat spit, Crimea, Ukraine	<2008	environmental-air
NC_010608	Arabat spit, Crimea, Ukraine	<2008	environmental-air
NC_010614	France	<2008	clinical potential
NC_010615	Taiwan	<2008	environmental
NC_010616	ND	<2007	clinical
NC_010621	ND	<2008	environmental-human
NC_010625	French Guiana	2000	environmental-plant and algae
NC_010626	Serbia	<2008	clinical
NC_010627	French Guiana	2000	environmental-plant and algae
NC_010629	Australia	<2008	environmental-plant and algae
NC_010630	Australia	<2008	environmental-plant and algae
NC_010631	Australia	<2008	environmental-plant and algae
NC_010632	Australia	<2008	environmental-plant and algae
NC_010633	Australia	<2008	environmental-plant and algae
NC_010635	ND	<2008	ND
NC_010643	Athens, Greece	<2007	ND
NC_010656	ND	<2008	ND
NC_010657	ND	<2008	ND
NC_010659	ND	<2008	ND
NC_010660	ND	<2008	ND
NC_010672	ND	<2008	ND
NC_010675	King George Island, Southern Shetlands, Antartica	<2008	environmental-animal
NC_010679	ND	<2008	environmental-plant and algae
NC_010680	ND	<2008	clinical
NC_010683	ND	<2008	ND
NC_010684	ND	<2007	ND
NC_010685	ND	<2007	ND
NC_010686	ND	<2007	ND
NC_010687	ND	<2007	ND
NC_010693	Australia	1999	environmental-plant and algae
NC_010695	Australia	1999	environmental-plant and algae
NC_010696	Australia	1999	environmental-plant and algae
NC_010697	Australia	1999	environmental-plant and algae
NC_010699	Australia	1999	environmental-plant and algae
NC_010715	Wadi Na Natrun, Egypt	<2008	environmental-marine
NC_010716	Derenburg, Germany	<2003	environmental-animal
NC_010719	ND	<2005	clinical
NC_010720	ND	<2005	clinical
NC_010721	ND	<2008	environmental-plant and algae
NC_010722	ND	<2008	environmental
NC_010724	Wadi An Natrun, Egypt	<2008	environmental-marine
NC_010726	Argentina	<2008	clinical
NC_010727	ND	<2008	environmental-plant and algae
NC_010728	ND	<2007	environmental-animal
NC_010733	New Caledonia	1997	veterinary
NC_010734	ND	<2007	veterinary
NC_010795	China	2005	veterinary
NC_010796	India	<2008	environmental
NC_010802	Berkeley, USA	<2007	environmental-soil
NC_010813	ND	<2008	clinical
NC_010815	ND	<2008	environmental-soil
NC_010841	ND	1970s	environmental-plant and algae
NC_010844	ND	1990	environmental-freshwater
NC_010846	ND	1990	environmental-freshwater
NC_010847	Japan	<2006	environmental-soil
NC_010848	Japan	<1983	environmental-wastewaters
NC_010849	Hunan Province, China	<2005	ND
NC_010850	ND	<2010	ND
NC_010851	Yunnan Province, China	<2005	environmental-soil
NC_010852	France	<2006	environmental-soil
NC_010853	ND	<2006	environmental-soil
NC_010854	ND	<2005	environmental-plant and algae
NC_010855	The Netherlands	2004	environmental-human
NC_010856	ND	<2005	environmental-plant and algae

NC_010857	ND	<2006	environmental-human
NC_010858	Australia	<1996	veterinary
NC_010859	ND	<2005	environmental-food
NC_010860	Taiwan	2003/6	clinical
NC_010861	ND	<2006	environmental-human
NC_010862	ND	<2006	clinical
NC_010863	ND	<2007	environmental
NC_010864	ND	<2005	environmental-food
NC_010865	Germany	<2006	environmental-plant and algae
NC_010867	The Netherlands	2004	environmental-human
NC_010868	The Netherlands	2004	environmental-human
NC_010869	The Netherlands	2004	environmental-human
NC_010870	Taiwan	2001	clinical
NC_010871	The Netherlands	2004	environmental-human
NC_010872	South Korea	2000/1	environmental-plant and algae
NC_010873	ND	<2007	environmental
NC_010874	China	<2006	environmental-soil
NC_010875	California, USA	2003	veterinary
NC_010876	USA	2000/1	environmental-plant and algae
NC_010877	ND	<2005	environmental-animal
NC_010878	China	<2007	environmental-freshwater
NC_010879	South Korea	2003	environmental-plant and algae
NC_010880	Spain	<2005	environmental-food
NC_010881	Canada	1985	clinical
NC_010882	USA	1998	environmental-freshwater
NC_010883	ND	<2006	clinical
NC_010884	Korea	<2006	clinical
NC_010885	Poland	<2005	clinical
NC_010886	Taiwan	2002	clinical
NC_010887	USA	2000/1	environmental-plant and algae
NC_010888	The Netherlands	2004	environmental-human
NC_010889	Spain	<2006	veterinary
NC_010890	China	<2007	environmental-freshwater
NC_010891	ND	<2005	environmental-wastewaters
NC_010893	USA	<2004	veterinary
NC_010894	Guiyang city, China	2005	clinical
NC_010895	China	<2006	environmental
NC_010896	ND	<2007	clinical
NC_010897	Hong Kong	2005	environmental-marine
NC_010898	ND	<2006	clinical
NC_010899	Hong Kong	2005	environmental-marine
NC_010900	USA	<2004	veterinary
NC_010901	ND	<2004	environmental-food
NC_010902	ND	<2006	environmental-plant and algae
NC_010903	ND	<2006	environmental-plant and algae
NC_010904	ND	<2005	ND
NC_010905	Czechoslovakia	<2007	clinical
NC_010906	The Netherlands	2004	environmental-human
NC_010907	ND	<2005	clinical
NC_010908	ND	<2007	environmental-animal
NC_010909	ND	<2006	environmental-food
NC_010910	Hong Kong	2005	environmental-marine
NC_010912	Taiwan	1995	veterinary
NC_010913	ND	<2007	environmental-food
NC_010914	ND	<2007	environmental-food
NC_010915	ND	<2006	environmental
NC_010917	ND	<2006	environmental
NC_010918	Deception Bay, southeast Queensland, Australia	<2005	environmental-plant and algae
NC_010919	ND	<2006	veterinary
NC_010920	Australia	<2005	environmental-plant and algae
NC_010922	The Netherlands	2004	environmental-human
NC_010923	The Netherlands	2004	environmental-human
NC_010924	United Kingdom	1972	clinical
NC_010926	The Netherlands	2004	environmental-human
NC_010927	ND	<2007	clinical potential

NC_010928	The Netherlands	2004	environmental-human
NC_010929	ND	<2005	environmental-plant and algae
NC_010930	ND	<2006	environmental-human
NC_010931	The Netherlands	2004	environmental-human
NC_010932	ND	<2005	clinical potential
NC_010933	ND	<2006	clinical
NC_010934	ND	<2006	clinical
NC_010935	ND	<2005	environmental-wastewaters
NC_010936	ND	<2007	environmental-food
NC_010937	ND	<2006	clinical
NC_010938	Japan	<2006	environmental-food
NC_010940	ND	<2008	clinical
NC_010941	ND	<2008	clinical
NC_010942	ND	<2008	clinical
NC_010980	Norway	1999	environmental-animal
NC_010982	Recife, Brazil	1970	environmental-food
NC_010983	Republic of Korea	<2008	environmental-animal
NC_010993	Taiwan	2003/6	clinical
NC_010996	Costa Rica	<2008	environmental-plant and algae
NC_010997	Costa Rica	<2008	environmental-plant and algae
NC_010998	Costa Rica	<2008	environmental-plant and algae
NC_011003	ND	1989	clinical
NC_011030	Japan	<2008	environmental-food
NC_011034	Republic of Korea	<2008	clinical
NC_011061	sasyk-sivash, Crimea, Ukraine	1970	environmental-estuarine
NC_011073	Hungary	2000/4	clinical
NC_011076	ND	2002	clinical potential
NC_011077	ND	2002	clinical potential
NC_011078	ND	2002	clinical potential
NC_011079	USA	2000	clinical
NC_011081	USA	2003	clinical potential
NC_011082	USA	2003	clinical potential
NC_011092	ND	<2008	clinical potential
NC_011093	ND	<2008	clinical potential
NC_011101	Philippines	<2008	environmental-food
NC_011102	ND	<2008	environmental-animal
NC_011131	ND	<1999	environmental-animal
NC_011136	ND	<2008	environmental-food
NC_011139	ND	<2006	environmental-human
NC_011140	France	1986	clinical
NC_011143	China	<2007	clinical potential
NC_011148	Wisconsin, USA	2003	clinical
NC_011150	Valencia, Spain	<2008	clinical
NC_011151	Canada	<2008	veterinary
NC_011185	Steinhart Aquarium, California, USA	1991	veterinary
NC_011204	ND	<2008	veterinary
NC_011207	ND	<2008	veterinary
NC_011214	USA	2005	clinical
NC_011215	USA	2005	clinical
NC_011223	ND	<2008	environmental-human
NC_011224	Tanzania	<2008	clinical
NC_011225	ND	<2008	environmental-human
NC_011226	Tanzania	<2008	clinical
NC_011227	ND	<2008	clinical
NC_011228	ND	<2008	clinical
NC_011245	Tanzania	<2008	clinical
NC_011246	Ethiopia	<2008	clinical
NC_011247	Tanzania	<2008	clinical
NC_011248	Tanzania	<2008	clinical
NC_011249	Tanzania	<2008	clinical
NC_011250	Tanzania	<2008	clinical
NC_011251	Tanzania	<2008	clinical
NC_011252	Ethiopia	<2008	clinical
NC_011253	Ethiopia	<2008	clinical
NC_011254	Tanzania	<2008	clinical

NC_011255	Ethiopia	<2008	clinical
NC_011256	Tanzania	<2008	clinical
NC_011257	Tanzania	<2008	clinical
NC_011258	Ethiopia	<2008	clinical
NC_011259	Tanzania	<2008	clinical
NC_011260	Ethiopia	<2008	clinical
NC_011261	Tanzania	<2008	clinical
NC_011262	Tanzania	<2008	clinical
NC_011263	Ethiopia	<2008	clinical
NC_011264	Tanzania	<2008	clinical
NC_011265	Tanzania	<2008	clinical
NC_011266	ND	<2008	clinical
NC_011281	ND	<2008	environmental-plant and algae
NC_011282	ND	<2008	environmental-plant and algae
NC_011311	ND	<2008	veterinary
NC_011314	ND	<2008	veterinary
NC_011315	ND	<2008	veterinary
NC_011316	ND	<2008	veterinary
NC_011332	ND	<2005	environmental-human
NC_011334	Tuscany, Italy	<2008	clinical
NC_011336	ND	1998	clinical
NC_011337	ND	<2007	ND
NC_011338	ND	<2007	ND
NC_011339	ND	<2007	ND
NC_011340	ND	<2007	ND
NC_011341	ND	<2007	ND
NC_011342	ND	<2007	ND
NC_011350	USA	2006	clinical
NC_011351	USA	2006	clinical
NC_011352	Inner Mongolia, China	<2008	environmental-food
NC_011355	ND	<2007	veterinary
NC_011363	ND	<1998	ND
NC_011364	Japan	<2005	clinical
NC_011366	Uruguay	1998	environmental-plant and algae
NC_011367	Brazil	<2008	environmental-plant and algae
NC_011368	Uruguay	1998	environmental-plant and algae
NC_011370	Uruguay	1998	environmental-plant and algae
NC_011371	Uruguay	1998	environmental-plant and algae
NC_011376	ND	<1994	environmental
NC_011377	ND	<1993	environmental
NC_011378	Germany	<2008	veterinary
NC_011382	New york, USA	2005	clinical
NC_011383	New york, USA	2005	clinical
NC_011385	New york, USA	2005	clinical
NC_011396	Italy	<2002	environmental-soil
NC_011403	ND	<2003	veterinary
NC_011404	Japan	<2003	environmental-food
NC_011405	ND	<2004	clinical
NC_011406	ND	<2005	clinical
NC_011407	ND	<2006	environmental-human
NC_011408	ND	<2006	environmental-human
NC_011409	Surrey, UK	<2004	clinical
NC_011410	Padova, Italy	<2004	environmental-animal
NC_011411	ND	<2006	environmental-human
NC_011412	UK	1950s	veterinary
NC_011413	ND	<2006	environmental-human
NC_011414	USA	1991	veterinary
NC_011416	ND	<2006	environmental-human
NC_011418	Gdansk, Poland	<2004	clinical
NC_011419	ND	<2006	environmental-human
NC_011422	Indonesia	1981	clinical
NC_011497	USA	<1953	environmental-food
NC_011499	Germany	<2008	clinical
NC_011511	Paris, France	1999	clinical
NC_011512	Paris, France	1997	clinical

NC_011513	Paris, France	2002	clinical
NC_011514	Paris, France	2004	clinical
NC_011521	ND	<2008	clinical
NC_011522	Brazil	1990	environmental-food
NC_011526	Oregon, USA	1976	clinical
NC_011561	ND	<2008	environmental-animal
NC_011562	ND	<2008	environmental-animal
NC_011563	ND	<2008	environmental-animal
NC_011564	ND	<2008	environmental-animal
NC_011585	ND	2004	clinical
NC_011602	Taunton, UK	1969	clinical
NC_011603	Taunton, UK	1969	clinical
NC_011604	Morbihan, France	2004	environmental-food
NC_011605	Portugal	1992	clinical
NC_011610	ND	<2007	environmental-food
NC_011617	China	2002	clinical
NC_011640	China	<2008	clinical
NC_011641	Guangzhou, China	2003	clinical
NC_011642	Nagano, Nakano City, Japan	1999	clinical
NC_011647	Sweden	<2005	clinical
NC_011648	Sweden	<2005	clinical
NC_011649	Sweden	<2005	clinical
NC_011650	Sweden	<2005	clinical
NC_011651	Sweden	<2005	clinical
NC_011652	ND	<2008	environmental-food
NC_011654	London, UK	1972	clinical
NC_011655	London, UK	1972	clinical
NC_011656	London, UK	1972	clinical
NC_011657	London, UK	1972	clinical
NC_011664	Baltic Sea	<2008	environmental-marine
NC_011665	Baltic Sea	<2008	environmental-marine
NC_011667	Tennessee, USA	<2008	environmental-wastewaters
NC_011668	Baltic Sea	<2008	environmental-marine
NC_011720	ND	<2008	clinical
NC_011721	southern Taiwan	<2008	environmental-soil
NC_011722	ND	<2008	clinical
NC_011723	southern Taiwan	<2008	environmental-soil
NC_011724	ND	<2008	clinical
NC_011727	southern Taiwan	<2008	environmental-soil
NC_011730	Senegal	<2008	environmental-soil
NC_011731	ND	<2008	clinical
NC_011732	Senegal	<2008	environmental-soil
NC_011733	Senegal	<2008	environmental-soil
NC_011734	Senegal	<2008	environmental-soil
NC_011735	ND	<2008	clinical
NC_011736	ND	<2008	clinical
NC_011737	Senegal	<2008	environmental-soil
NC_011738	Senegal	<2008	environmental-soil
NC_011739	Minnesota, USA	1999	clinical
NC_011743	Missouri, USA	1985	clinical
NC_011746	ND	<2008	environmental-food
NC_011749	Minnesota, USA	1999	clinical
NC_011752	Central African Republic	<2008	clinical
NC_011754	France	2000s	environmental-human
NC_011758	Russia	<2008	environmental-soil
NC_011759	ND	<2008	clinical
NC_011760	Russia	<2008	environmental-soil
NC_011767	ND	<2008	environmental-plant and algae
NC_011771	Akershus, Norway	1995	clinical
NC_011774	Nebraska, USA	1996	clinical
NC_011775	Nebraska, USA	1996	clinical
NC_011776	Akershus, Norway	1995	clinical
NC_011777	Akershus, Norway	1996	clinical
NC_011778	ND	<2008	clinical
NC_011779	ND	<2008	clinical

NC_011780	ND	<2008	clinical
NC_011781	ND	<2008	clinical
NC_011782	ND	<2008	clinical
NC_011783	ND	<2008	clinical
NC_011784	ND	<2008	clinical
NC_011785	ND	<2008	clinical
NC_011786	Sweden	<2008	clinical
NC_011787	Sweden	<2008	clinical
NC_011788	Sweden	<2008	clinical
NC_011789	Sweden	<2008	clinical
NC_011790	Sweden	<2008	clinical
NC_011791	Sweden	<2008	clinical
NC_011792	Sweden	<2008	clinical
NC_011793	Sweden	<2008	clinical
NC_011794	Sweden	<2008	clinical
NC_011795	ND	<2008	clinical
NC_011796	ND	<2007	clinical
NC_011797	Kolkata, India	1998/2002	clinical
NC_011798	ND	<2008	environmental-food
NC_011799	ND	<2008	clinical
NC_011812	Canada	<2008	clinical
NC_011836	ND	<2005	ND
NC_011838	Tokyo, Japan	1993	environmental-wastewaters
NC_011839	Sendai, Japan	1991	environmental-human
NC_011840	Germany	<2008	clinical
NC_011841	ND	<2007	clinical
NC_011842	Germany	<2008	clinical
NC_011843	ND	<2007	clinical
NC_011844	ND	<2008	environmental-animal
NC_011845	ND	<2007	clinical
NC_011846	ND	<2007	clinical
NC_011847	ND	<2007	clinical
NC_011848	Germany	<2008	clinical
NC_011849	ND	<2007	clinical
NC_011850	ND	<2007	clinical
NC_011851	ND	<2007	clinical
NC_011853	ND	<2007	clinical
NC_011854	Germany	<2008	clinical
NC_011855	Germany	<2008	clinical
NC_011856	Germany	<2008	clinical
NC_011857	Germany	<2008	clinical
NC_011858	Germany	<2008	clinical
NC_011859	Germany	<2008	clinical
NC_011860	Germany	<2008	clinical
NC_011861	Germany	<2008	clinical
NC_011862	ND	<2007	clinical
NC_011863	ND	<2007	clinical
NC_011864	ND	<2007	clinical
NC_011865	ND	<2007	clinical
NC_011866	ND	<2007	clinical
NC_011867	ND	<2008	environmental-animal
NC_011868	ND	<2007	clinical
NC_011869	ND	<2008	environmental-animal
NC_011870	ND	<2007	clinical
NC_011871	ND	<2008	environmental-animal
NC_011872	ND	<2007	clinical
NC_011873	ND	<2008	environmental-animal
NC_011874	ND	<2007	clinical
NC_011875	ND	<2008	environmental-animal
NC_011876	ND	<2007	clinical
NC_011877	ND	<2008	environmental-animal
NC_011878	ND	<2003	environmental-animal
NC_011879	Fort Collins, Colorado, USA	1983	environmental-soil
NC_011880	Senegal	<2009	environmental-food
NC_011881	Fort Collins, Colorado, USA	1983	environmental-soil

NC_011882	Senegal	<2009	environmental-food
NC_011885	Senegal	<2009	environmental-food
NC_011887	Senegal	<2009	environmental-plant and algae
NC_011888	Senegal	<2009	environmental-plant and algae
NC_011889	Senegal	<2009	environmental-plant and algae
NC_011890	Senegal	<2009	environmental-plant and algae
NC_011892	Senegal	<2009	environmental-plant and algae
NC_011893	Senegal	<2009	environmental-plant and algae
NC_011895	Senegal	<2009	environmental-plant and algae
NC_011897	China	2006/7	clinical
NC_011917	ND	<2008	clinical
NC_011960	South Korea	<2008	environmental-marine
NC_011961	ND	<2008	environmental-freshwater
NC_011962	South Korea	<2008	environmental-marine
NC_011964	USA	<2008	veterinary
NC_011965	USA	<2007	clinical
NC_011966	USA	<2007	clinical
NC_011967	USA	<2007	clinical
NC_011968	USA	<2007	clinical
NC_011970	USA	<2007	clinical
NC_011971	China	<2005	environmental-soil
NC_011972	USA	<2007	clinical
NC_011973	China	<2005	environmental-soil
NC_011974	USA	<2007	clinical
NC_011975	USA	<2007	clinical
NC_011977	ND	<1986	environmental-animal
NC_011980	Missouri, USA	<2007	veterinary
NC_011981	Orgovany, Hungary	1981	environmental-plant and algae
NC_011982	Orgovany, Hungary	1981	environmental-plant and algae
NC_011984	Orgovany, Hungary	1981	environmental-plant and algae
NC_011986	Orgovany, Hungary	1981	environmental-plant and algae
NC_011987	Australia	1972	environmental-plant and algae
NC_011990	Australia	1972	environmental-plant and algae
NC_011991	Orgovany, Hungary	1981	environmental-plant and algae
NC_011994	Australia	1972	environmental-plant and algae
NC_011995	Japan	<2007	environmental-food
NC_011996	Japan	<2007	environmental-food
NC_011997	Japan	<2007	environmental-food
NC_011998	Japan	<2007	environmental-food
NC_012000	Japan	<2007	environmental-food
NC_012001	Japan	<2007	environmental-food
NC_012002	Japan	<2007	environmental-food
NC_012003	Japan	<2007	environmental-food
NC_012006	Calgary, Canada	2006	clinical
NC_012031	Galicia, Ribeira Sacra, Spain	<2008	environmental-food
NC_012033	Antarctica	<2009	environmental-soil
NC_012035	ND	2008	environmental-marine
NC_012036	Russia	<2009	environmental-freshwater
NC_012037	Russia	<2009	environmental-freshwater
NC_012040	Atlanta, USA	<2008	environmental-human
NC_012088	Saga Prefecture, Japan	1982	environmental-plant and algae
NC_012089	Saga Prefecture, Japan	1993	environmental-plant and algae
NC_012090	Saga Prefecture, Japan	1995	environmental-plant and algae
NC_012104	ND	<2008	clinical
NC_012105	ND	<2008	clinical
NC_012106	ND	<2008	clinical
NC_012107	ND	<2008	clinical
NC_012109	Venice, Italy	<2008	environmental-marine
NC_012110	ND	<2008	clinical
NC_012111	ND	<2008	clinical
NC_012112	ND	<2008	clinical
NC_012113	ND	<2008	clinical
NC_012114	ND	<2008	clinical
NC_012124	ND	<2007	clinical
NC_012128	Switzerland	<2007	clinical potential

NC_012129	Switzerland	<2007	clinical potential
NC_012130	Switzerland	<2007	clinical potential
NC_012131	Switzerland	<2007	clinical potential
NC_012132	Switzerland	<2007	clinical potential
NC_012133	Switzerland	<2007	clinical potential
NC_012148	ND	<2008	clinical
NC_012149	ND	<2008	clinical
NC_012150	ND	<2008	clinical
NC_012151	ND	<2008	clinical
NC_012152	ND	<2008	clinical
NC_012153	ND	<2008	clinical
NC_012154	ND	<2008	clinical
NC_012155	ND	<2008	clinical
NC_012156	ND	<2008	clinical
NC_012157	ND	<2008	clinical
NC_012158	ND	<2008	clinical
NC_012159	ND	<2008	clinical
NC_012160	ND	<2008	clinical
NC_012161	ND	<2008	clinical
NC_012162	ND	<2008	clinical
NC_012163	ND	<2008	clinical
NC_012164	The Netherlands	<2008	clinical potential
NC_012165	ND	<2008	clinical
NC_012166	Switzerland	<2007	clinical potential
NC_012167	ND	<2008	clinical
NC_012168	ND	<2008	clinical
NC_012169	Switzerland	<2007	clinical potential
NC_012170	ND	<2008	clinical
NC_012171	ND	<2008	clinical
NC_012172	USA	<2007	clinical
NC_012173	The Netherlands	<2008	clinical potential
NC_012174	ND	<2008	clinical
NC_012175	ND	<2008	clinical
NC_012176	The Netherlands	<2008	clinical potential
NC_012177	Switzerland	<2007	clinical potential
NC_012178	ND	<2008	clinical
NC_012179	ND	<2008	clinical
NC_012180	Switzerland	<2007	clinical potential
NC_012181	The Netherlands	<2008	clinical potential
NC_012182	ND	<2008	clinical
NC_012183	The Netherlands	<2008	clinical potential
NC_012184	ND	<2008	clinical
NC_012185	Switzerland	<2007	clinical potential
NC_012186	USA	<2007	clinical
NC_012187	ND	<2008	clinical
NC_012188	ND	<2008	clinical
NC_012189	ND	<2008	clinical
NC_012190	The Netherlands	<2008	clinical potential
NC_012191	USA	<2007	clinical
NC_012192	ND	<2008	clinical
NC_012193	USA	<2007	clinical
NC_012194	ND	<2008	clinical
NC_012195	ND	<2008	clinical
NC_012196	ND	<2008	clinical
NC_012197	ND	<2008	clinical
NC_012198	ND	<2008	clinical
NC_012199	ND	<2008	clinical
NC_012200	The Netherlands	<2008	clinical potential
NC_012201	USA	<2007	clinical
NC_012202	ND	<2008	clinical
NC_012203	ND	<2008	clinical
NC_012204	Switzerland	<2007	clinical potential
NC_012208	ND	<2009	clinical potential
NC_012209	ND	<2009	clinical potential
NC_012215	Spain	<2008	veterinary

NC_012216	Spain	<2008	veterinary
NC_012219	ND	<2008	ND
NC_012220	ND	<2009	environmental-food
NC_012222	ND	<2008	environmental-food
NC_012226	Australia	<2009	veterinary
NC_012227	ND	<2008	clinical
NC_012228	ND	<2008	clinical
NC_012229	ND	<2007	clinical
NC_012230	Finland	<2008	clinical potential
NC_012231	USA	<2007	clinical
NC_012232	ND	<2007	clinical
NC_012233	ND	<2007	clinical
NC_012234	Finland	<2008	clinical potential
NC_012235	USA	<2007	clinical
NC_012236	ND	<2007	clinical
NC_012237	USA	<2007	clinical
NC_012238	ND	<2007	clinical
NC_012239	Finland	<2008	clinical potential
NC_012240	ND	<2007	clinical
NC_012241	ND	<2007	clinical
NC_012242	Finland	<2008	clinical potential
NC_012243	ND	<2007	clinical
NC_012244	USA	<2007	clinical
NC_012245	ND	<2007	clinical
NC_012246	USA	<2007	clinical
NC_012247	Finland	<2008	clinical potential
NC_012248	ND	<2007	clinical
NC_012249	USA	<2007	clinical
NC_012250	USA	<2007	clinical
NC_012251	ND	<2007	clinical
NC_012252	Finland	<2008	clinical potential
NC_012253	ND	<2007	clinical
NC_012254	USA	<2007	clinical
NC_012255	USA	<2007	clinical
NC_012256	ND	<2007	clinical
NC_012257	ND	<2007	clinical
NC_012258	USA	<2007	clinical
NC_012259	USA	<2007	clinical
NC_012260	Finland	<2008	clinical potential
NC_012261	ND	<2007	clinical
NC_012262	ND	<2007	clinical
NC_012263	USA	<2007	clinical
NC_012264	ND	<2007	clinical
NC_012265	Finland	<2008	clinical potential
NC_012266	ND	<2007	clinical
NC_012267	Finland	<2008	clinical potential
NC_012268	ND	<2007	clinical
NC_012269	USA	<2007	clinical
NC_012417	Texas, USA	<2009	clinical
NC_012439	USA	<2008	environmental-marine
NC_012473	ND	<2009	clinical
NC_012487	Canada	<2008	clinical
NC_012494	ND	<2007	clinical
NC_012495	ND	<2008	clinical
NC_012496	ND	<2007	clinical
NC_012497	ND	<2007	clinical
NC_012498	ND	<2008	clinical
NC_012499	ND	<2007	clinical
NC_012500	ND	<2008	clinical
NC_012501	ND	<2008	clinical
NC_012502	ND	<2008	clinical
NC_012503	ND	<2008	clinical
NC_012504	ND	<2007	clinical
NC_012505	ND	<2008	clinical
NC_012506	ND	<2007	clinical

NC_012507	ND	<2008	clinical
NC_012508	ND	<2008	clinical
NC_012509	ND	<2007	clinical
NC_012510	ND	<2008	clinical
NC_012511	ND	<2008	clinical
NC_012512	ND	<2007	clinical
NC_012513	ND	<2008	clinical
NC_012514	ND	<2008	clinical
NC_012515	ND	<2007	clinical
NC_012516	ND	<2008	clinical
NC_012517	ND	<2008	clinical
NC_012518	ND	<2007	clinical
NC_012520	Hiroshima, Japan	<2009	environmental-soil
NC_012521	Hiroshima, Japan	<2009	environmental-soil
NC_012523	Hiroshima, Japan	<2009	environmental-soil
NC_012527	Morocco	<2008	environmental-soil
NC_012528	Morocco	<2008	environmental-soil
NC_012529	Morocco	<2008	environmental-soil
NC_012547	USA	1980	clinical
NC_012548	ND	<2007	environmental-food
NC_012549	ND	<2007	environmental-food
NC_012550	ND	<2007	environmental-food
NC_012551	ND	<2007	environmental-food
NC_012552	ND	<2004	environmental-animal
NC_012555	Taiwan	2004	clinical
NC_012556	Taiwan	2004	clinical
NC_012562	ND	<2008	environmental-food
NC_012577	ND	<2008	clinical
NC_012579	ND	<2008	clinical
NC_012586	ND	<2004	environmental-soil
NC_012625	Malmo, Sweden	2002	clinical
NC_012626	Malmo, Sweden	2002	clinical
NC_012627	Malmo, Sweden	2002	clinical
NC_012628	ND	<2008	environmental-food
NC_012629	The Gambia	<2008	clinical
NC_012630	Sweden	2006	clinical
NC_012631	Malmo, Sweden	2002	clinical
NC_012634	Ethiopia	1966	veterinary
NC_012642	ND	<2008	clinical
NC_012654	Texas, USA	<2008	clinical
NC_012655	ND	<2009	clinical
NC_012656	ND	<2009	clinical
NC_012657	Texas, USA	<2008	clinical
NC_012661	China	2007/8	veterinary
NC_012674	ND	<2005	environmental-freshwater
NC_012690	Washington, USA	2002	environmental-animal
NC_012692	Illinois, USA	2002	environmental-animal
NC_012693	Kansas, USA	1998	clinical
NC_012718	Korea	<2009	environmental-plant and algae
NC_012720	Korea	<2009	environmental-plant and algae
NC_012722	Muan,Mokpo National University, South Korea	2007	environmental-food
NC_012723	Korea	<2009	environmental-plant and algae
NC_012725	Korea	<2009	environmental-plant and algae
NC_012733	Belgium	<2008	clinical potential
NC_012752	Madison, Wisconsin, USA	<2009	environmental-animal
NC_012758	Hong Kong	<2005	environmental-freshwater
NC_012760	ND	<2007	environmental-human
NC_012780	ND	<2008	environmental-human
NC_012782	ND	<2008	environmental-human
NC_012790	ND	<2009	ND
NC_012794	ND	<2009	ND
NC_012795	Wakayama prefecture, Japan	1993	environmental-freshwater
NC_012797	Wakayama prefecture, Japan	1993	environmental-freshwater
NC_012807	Oxford, UK	1960	environmental-air
NC_012809	Oxford, UK	1960	environmental-air

NC_012810	Oxford, UK	1960	environmental-air
NC_012811	Oxford, UK	1960	environmental-air
NC_012813	Northern Italy, Varese, Italy	2000	veterinary
NC_012847	Sweden	<2009	veterinary
NC_012848	Greece	1993	environmental-plant and algae
NC_012849	Michigan, USA	<2009	environmental-freshwater
NC_012851	Michigan, USA	<2009	environmental-freshwater
NC_012852	Greece	1993	environmental-plant and algae
NC_012853	Greece	1993	environmental-plant and algae
NC_012854	Greece	1993	environmental-plant and algae
NC_012855	Michigan, USA	<2009	environmental-freshwater
NC_012858	Greece	1993	environmental-plant and algae
NC_012859	ND	<2009	clinical potential
NC_012882	New York, USA	1922	clinical
NC_012885	Japan	1971	veterinary
NC_012886	Japan	1980	veterinary
NC_012916	The Netherlands	2001/6	clinical
NC_012919	Nagasaki, Japan	<2009	veterinary
NC_012923	Ho Chi Minh City, Vietnam	2004	clinical
NC_012944	USA	<2008	veterinary
NC_012961	Maryland, USA	1977	clinical
NC_012970	Seattle, USA	<2009	environmental-freshwater
NC_012972	Seattle, USA	<2009	environmental-freshwater
NC_012983	Germany	1982	environmental-freshwater
NC_012987	Switzerland	<2009	environmental-wastewaters
NC_012989	Switzerland	<2009	environmental-wastewaters
NC_013010	USA	2005/7	clinical
NC_013033	ND	<2008	ND
NC_013034	Lower Saxony, Germany	2004	veterinary
NC_013056	Spain	<2009	clinical
NC_013090	Goiania Savanna, Brazil	<2009	environmental-plant and algae
NC_013091	ND	<2008	environmental-freshwater
NC_013092	ND	<2008	environmental-freshwater
NC_013104	Australia	2000	veterinary
NC_013120	United Kingdom	2008	clinical
NC_013121	United Kingdom	2008	clinical
NC_013122	United Kingdom	2008	clinical
NC_013128	Conneticut, USA	1982	clinical potential
NC_013129	ND	<2009	clinical potential
NC_013130	ND	<2009	clinical potential
NC_013160	Taiwan	<2009	environmental-freshwater
NC_013163	Taiwan	<2009	environmental-freshwater
NC_013164	Washington, USA	1948	clinical
NC_013167	Taiwan	<2009	environmental-freshwater
NC_013168	Taiwan	<2009	environmental-freshwater
NC_013175	ND	<2009	clinical
NC_013176	china	<2009	environmental
NC_013178	ND	<2009	environmental
NC_013190	USA	2004	environmental-wastewaters
NC_013191	USA	2004	environmental-wastewaters
NC_013193	USA	2004	environmental-wastewaters
NC_013200	ND	<2008	environmental-food
NC_013206	USA	1971	environmental-freshwater
NC_013207	USA	1971	environmental-freshwater
NC_013208	USA	1971	environmental-freshwater
NC_013210	Osaka, Japan	1974	environmental-food
NC_013211	Osaka, Japan	1974	environmental-food
NC_013212	Osaka, Japan	1974	environmental-food
NC_013213	Osaka, Japan	1974	environmental-food
NC_013214	Osaka, Japan	1974	environmental-food
NC_013215	Osaka, Japan	1974	environmental-food
NC_013224	Lake Retba, Senegal	<2009	environmental-marine
NC_013263	Korea	<2009	environmental-plant and algae
NC_013264	Korea	<2009	environmental-plant and algae
NC_013265	Korea	<2009	environmental-plant and algae

NC_013277	Madrid, Spain	<2009	clinical
NC_013283	Zurich, Switzerland	2005	clinical potential
NC_013284	Zurich, Switzerland	2005	clinical potential
NC_013285	Zurich, Switzerland	2005	clinical potential
NC_013289	California, USA	2002	clinical
NC_013290	Western Australia	1995	clinical
NC_013291	Western Australia	1995	clinical
NC_013292	remote Western Australia, Australia	1995	clinical
NC_013293	remote Western Australia, Australia	1995	clinical
NC_013294	Clarke County, Georgia, USA	2005	veterinary
NC_013295	Clarke County, Georgia, USA	2005	veterinary
NC_013296	USA	<2009	clinical
NC_013297	USA	<2009	clinical
NC_013298	USA	<2009	clinical
NC_013299	USA	<2009	clinical
NC_013300	USA	<2009	clinical
NC_013301	USA	<2009	clinical
NC_013302	London, UK	2003	clinical
NC_013303	UK	2004	environmental
NC_013304	Oxford, UK	1999	clinical
NC_013305	United Kingdom	2007	clinical
NC_013306	Melbourne, Australia	1953	clinical
NC_013307	Melbourne, Australia	1965	clinical
NC_013308	Melbourne, Australia	1966	clinical
NC_013309	Melbourne, Australia	1965	clinical
NC_013310	Melbourne, Australia	1965	clinical
NC_013311	Melbourne, Australia	1981	clinical
NC_013312	Melbourne, Australia	1960	clinical
NC_013313	remote Western Australia, Australia	1995	clinical
NC_013314	United Kingdom	1987	clinical
NC_013317	ND	<2009	clinical
NC_013318	Georgia, USA	1995	clinical
NC_013319	USA	1963	clinical
NC_013320	Mississippi, USA	2000	clinical
NC_013321	Hendersonville County, North Carolina, USA	2000	veterinary
NC_013322	USA	1935	clinical
NC_013323	Medellin, Colombia	2005	clinical
NC_013324	USA	<2009	clinical
NC_013325	remote Western Australia, Australia	2001	clinical
NC_013326	remote Western Australia, Australia	2001	clinical
NC_013327	remote Western Australia, Australia	1995	clinical
NC_013328	remote Western Australia, Australia	1995	clinical
NC_013329	remote Western Australia, Australia	1996	clinical
NC_013330	remote Western Australia, Australia	1995	clinical
NC_013331	USA	<2009	clinical
NC_013332	USA	<2009	clinical
NC_013333	Oxford, UK	1999	clinical
NC_013334	Oxford, UK	1999	clinical
NC_013335	USA	<2009	clinical
NC_013336	USA	<2009	clinical
NC_013337	United Kingdom	1987	clinical
NC_013338	St George's Hospital, London, UK	1999	clinical
NC_013339	St George's Hospital, London, UK	1999	clinical
NC_013340	St George's Hospital, London, UK	1999	clinical
NC_013341	USA	1982	clinical
NC_013342	Georgia, USA	<2009	clinical
NC_013343	Tenessee, USA	<2009	clinical
NC_013344	Pennsylvania, USA	<2009	clinical
NC_013345	Melbourne, Australia	1965	clinical
NC_013346	Melbourne, Australia	1947	clinical
NC_013347	Melbourne, Australia	1967	clinical
NC_013348	Melbourne, Australia	1951	clinical
NC_013349	Melbourne, Australia	1951	clinical
NC_013350	Royal Perth Hospital, Western Australia, Australia	2003	clinical
NC_013351	United Kingdom	1987	clinical

NC_013352	Melbourne, Australia	1960	clinical
NC_013354	Japan	2001	clinical
NC_013356	UK	<2009	environmental-food
NC_013357	UK	<2009	environmental-food
NC_013358	UK	<2009	environmental-food
NC_013362	Japan	2001	clinical
NC_013363	Japan	2001	clinical
NC_013365	Japan	2001	clinical
NC_013366	Japan	2001	clinical
NC_013367	Japan	2001	clinical
NC_013368	Japan	2001	clinical
NC_013369	Japan	2001	clinical
NC_013370	Japan	2001	clinical
NC_013371	Georgia, USA	2001	veterinary
NC_013372	Georgia, USA	1999	clinical
NC_013373	Georgia, USA	1996	clinical
NC_013374	Florida, USA	2000	clinical
NC_013375	Bangkok, Thailand	1998	clinical
NC_013376	Bangkok, Thailand	1998	clinical
NC_013377	Melbourne, Australia	1946	clinical
NC_013378	Melbourne, Australia	1946	clinical
NC_013379	Melbourne, Australia	1946	clinical
NC_013380	Melbourne, Australia	1946	clinical
NC_013381	Melbourne, Australia	1980	clinical
NC_013382	Melbourne, Australia	1980	clinical
NC_013383	Sydney, Australia	2000	clinical
NC_013384	Sydney, Australia	2000	clinical
NC_013386	ND	<2009	environmental-freshwater
NC_013387	USA	2001	clinical
NC_013388	USA	2001	clinical
NC_013389	Melbourne, Australia	1980	clinical
NC_013390	Melbourne, Australia	1980	clinical
NC_013391	Melbourne, Australia	1980	clinical
NC_013392	Melbourne, Australia	1980	clinical
NC_013393	Melbourne, Australia	1980	clinical
NC_013394	Melbourne, Australia	1980	clinical
NC_013395	Melbourne, Australia	1980	clinical
NC_013412	USA	2015	environmental-freshwater
NC_013417	China	<2010	environmental-animal
NC_013419	ND	<2009	environmental-animal
NC_013420	Shanghai	2010	environmental-plant and algae
NC_013437	Malawi	2004	clinical
NC_013442	Japan	1971	clinical
NC_013448	ND	<2009	clinical
NC_013449	ND	<2009	environmental-plant and algae
NC_013451	N. Ireland (United Kingdom)	1996/7	veterinary
NC_013452	N. Ireland (United Kingdom)	1996/7	veterinary
NC_013453	N. Ireland (United Kingdom)	1996/7	veterinary
NC_013500	ND	<2009	veterinary
NC_013502	Iceland	1988	environmental-marine
NC_013503	Australia, Princess Alexandra Hospital	2009	clinical
NC_013505	ND	<2009	environmental
NC_013506	Madrid, Spain	2010	clinical
NC_013507	Bangladesh	1971	clinical
NC_013509	China	2009	veterinary
NC_013513	ND	<2009	environmental-soil
NC_013514	ND	<2009	clinical
NC_013516	France	2009	clinical
NC_013518	ND	<2009	environmental-animal
NC_013519	ND	<2009	environmental-animal
NC_013531	Spain	2010	environmental-soil
NC_013533	USA	2006	clinical
NC_013534	China	2010	environmental-soil
NC_013537	ND	<2005	environmental-plant and algae
NC_013538	ND	<2005	environmental-wastewaters

NC_013539	china	2009	environmental-marine
NC_013540	china	2009	environmental-marine
NC_013541	China	2009	environmental-food
NC_013542	Wenzhou, China	2006	clinical
NC_013543	ND	<2004	environmental-human
NC_013544	ND	<2004	environmental-human
NC_013545	ND	<2005	ND
NC_013546	Spain	1997/2001	veterinary
NC_013547	ND	<2005	clinical
NC_013548	ND	<2005	environmental
NC_013549	ND	<2004	environmental-animal
NC_013550	ND	<2005	clinical potential
NC_013551	ND	<2005	environmental-food
NC_013589	ND	<2005	environmental-human
NC_013596	USA	1955	environmental-soil
NC_013636	China	<2014	environmental-freshwater
NC_013652	ND	<2009	clinical
NC_013653	Tenerife, Spain	2002	clinical
NC_013655	ND	<2007	environmental-human
NC_013657	ND	<2009	environmental-plant and algae
NC_013667	ND	<2009	environmental
NC_013717	ND	1993	veterinary
NC_013718	ND	1993	veterinary
NC_013719	ND	1993	veterinary
NC_013726	Japan	<2009	environmental
NC_013727	Vietnam	2007	clinical
NC_013728	ND	<2009	clinical
NC_013767	Canada	2008	clinical
NC_013775	Chesapeake Bay, USA	2005	veterinary
NC_013776	Slovakia	<2005	environmental-animal
NC_013779	China	<2011	environmental-soil
NC_013780	India	<2014	environmental-freshwater
NC_013782	Bolivia	2009	environmental-human
NC_013783	ND	<2005	environmental-food
NC_013784	ND	<2010	environmental-food
NC_013785	ND	<2010	environmental-food
NC_013786	ND	<2010	environmental-food
NC_013787	ND	<2010	environmental-food
NC_013788	ND	<2010	environmental-food
NC_013789	China	2010	environmental-food
NC_013792	ND	<2010	environmental-soil
NC_013793	ND	<2010	environmental-soil
NC_013852	ND	<2010	environmental-freshwater
NC_013855	Detroit, USA	<2009	environmental-plant and algae
NC_013856	Detroit, USA	<2009	environmental-plant and algae
NC_013857	Detroit, USA	<2009	environmental-plant and algae
NC_013858	Detroit, USA	<2009	environmental-plant and algae
NC_013859	Detroit, USA	<2009	environmental-plant and algae
NC_013860	Detroit, USA	<2009	environmental-plant and algae
NC_013862	ND	<2010	environmental-freshwater
NC_013930	Russia, Altai	2011	environmental-marine
NC_013937	South Carolina, USA	1999	clinical potential
NC_013938	South Carolina, USA	1999	clinical potential
NC_013940	Japan	2003	environmental-marine
NC_013942	Germany	2003	clinical
NC_013944	ND	<2009	veterinary
NC_013945	ND	<2009	veterinary
NC_013950	China	2000/8	clinical
NC_013951	China	2000/8	clinical
NC_013952	China	2010	environmental-food
NC_013954	Korea; Japan	2010	environmental-plant and algae
NC_013957	ND	1972	environmental-plant and algae
NC_013958	ND	<2009	ND
NC_013962	ND	<2008	ND
NC_013963	China	2010	veterinary

NC_013969	Czech Republic	2000/8	clinical
NC_013970	Japan	2011	environmental-soil
NC_013972	USA	2010	environmental-plant and algae
NC_013973	USA	2010	environmental-plant and algae
NC_014003	USA	2010	clinical
NC_014005	Japan	2010	environmental-soil
NC_014007	Japan	2010	environmental-soil
NC_014009	Japan	2010	environmental-soil
NC_014015	USA	2011	environmental-soil
NC_014016	USA	1994	clinical
NC_014017	Yulong County, China	2006	clinical
NC_014022	Yulong County, China	2006	clinical
NC_014023	USA	1967	environmental
NC_014025	USA	1967	environmental
NC_014026	Santa Pola, Spain	2010	environmental-marine
NC_014027	Yulong County, China	2006	clinical
NC_014028	Santa Pola, Spain	2010	environmental-marine
NC_014030	Santa Pola, Spain	2010	environmental-marine
NC_014031	USA	1967	environmental
NC_014035	Missouri, USA	<2008	environmental-soil
NC_014104	China	<2010	ND
NC_014105	Amsterdan, Netherlands	2010	clinical
NC_014107	USA	1890	clinical
NC_014108	USA	1890	clinical
NC_014111	USA	2005	environmental-plant and algae
NC_014113	USA	2005	environmental-plant and algae
NC_014120	Mexico, Nayarit, Tepic	2012	environmental-plant and algae
NC_014123	Czech Republic	<2011	environmental-plant and algae
NC_014124	Japan	1961	environmental-soil
NC_014131	Korea; Japan	2010	environmental-food
NC_014132	Korea; Japan	2010	environmental-food
NC_014133	Korea; Japan	2010	environmental-food
NC_014134	Korea; Japan	2010	environmental-food
NC_014135	Korea; Japan	2010	environmental-food
NC_014144	Côte d'Azur, France	<2010	environmental-wastewaters
NC_014149	Holstein,Germany	2010	environmental-freshwater
NC_014154	Hamburg,Germany	<2010	environmental-wastewaters
NC_014155	Hamburg,Germany	<2010	environmental-wastewaters
NC_014156	Germany	2004	veterinary
NC_014157	Mallorca, Spain	2002	environmental-marine
NC_014159	USA	1941	environmental-animal
NC_014161	ND	<2010	ND
NC_014162	ND	<2010	ND
NC_014163	ND	<2010	ND
NC_014164	Greece	<2010	environmental-food
NC_014167	Germany	<2012	clinical
NC_014170	USA	2011	environmental-animal
NC_014172	China	<2010	ND
NC_014208	Bolzano, Italy	2010	environmental-human
NC_014213	Vizela, Portugal	2010	environmental-freshwater
NC_014214	Vizela, Portugal	2010	environmental-freshwater
NC_014226	ND	<2010	veterinary
NC_014227	Brazil	2002	environmental-plant and algae
NC_014231	Germany	2006	clinical
NC_014232	Hong Kong, China	<2010	clinical
NC_014233	Hong Kong, China	<2010	clinical
NC_014234	Hong Kong, China	<2010	clinical
NC_014235	Hong Kong, China	<2010	clinical
NC_014247	Normandy,France	2010	veterinary
NC_014249	ND	<2010	environmental-plant and algae
NC_014250	ND	<2010	environmental-plant and algae
NC_014255	Asturias,Spain	2010	environmental-food
NC_014257	ND	<2010	clinical
NC_014258	Michigan, USA	2010	environmental-plant and algae
NC_014304	ND	<2009	environmental-plant and algae

NC_014305	ND	<2009	environmental-plant and algae
NC_014308	Indonesia	2010	environmental-plant and algae
NC_014309	France	2010	environmental-plant and algae
NC_014310	Indonesia	2010	environmental-plant and algae
NC_014312	China	2006	clinical
NC_014316	ND	<2010	ND
NC_014317	ND	<2010	ND
NC_014331	Ivory Coast; Cameroon	2010	veterinary
NC_014332	Ivory Coast; Cameroon	2010	veterinary
NC_014333	Ivory Coast; Cameroon	2010	veterinary
NC_014354	Goiânia, Goiás, Brazil	2008	clinical potential
NC_014356	Switzerland	1998	clinical
NC_014367	Greece	2010	environmental-food
NC_014368	Athens, Greece	2007	clinical
NC_014369	Melbourne, Australia	1979/82	clinical
NC_014382	Belgium	2010	clinical
NC_014383	Belgium	2010	veterinary
NC_014384	Belgium	2010	clinical
NC_014385	Belgium	2010	clinical
NC_014386	ND	1990	environmental-food
NC_014389	ND	<2009	environmental-animal
NC_014390	ND	<2009	environmental-animal
NC_014466	Kyoto, Japan	<2009	environmental-soil
NC_014475	USA	2002	clinical
NC_014476	Hokkaido,Japan	2002	veterinary
NC_014477	United Kingdom	2004	veterinary
NC_014478	Denmark	<2010	clinical
NC_014495	United Kingdom	1935	clinical
NC_014496	ND	1967	veterinary
NC_014502	India	<2010	environmental-freshwater
NC_014503	India	<2010	environmental-freshwater
NC_014504	India	<2010	environmental-freshwater
NC_014508	China	2009	environmental-animal
NC_014533	India	<2010	environmental-freshwater
NC_014534	India	<2010	environmental-freshwater
NC_014535	India	<2010	environmental-freshwater
NC_014543	Japan	2001	clinical
NC_014544	Australia	2009	clinical potential
NC_014548	ND	<2010	environmental-food
NC_014549	ND	<2010	environmental-food
NC_014553	ND	<2009	environmental-food
NC_014556	Peru	<2010	clinical
NC_014557	China	2011	veterinary
NC_014558	China	<2012	environmental-food
NC_014561	Michigan, USA	2010	environmental-plant and algae
NC_014563	Michigan, USA	2010	environmental-plant and algae
NC_014565	ND	<2010	environmental-freshwater
NC_014615	Paris, France	2004	clinical
NC_014617	ND	<2003	ND
NC_014619	ND	<2010	environmental-animal
NC_014620	ND	<2010	environmental-animal
NC_014621	ND	<2010	ND
NC_014626	ND	<2010	ND
NC_014627	China	2011	environmental-food
NC_014628	Guizhou, China	2010	environmental-plant and algae
NC_014633	Germany	1984	environmental-marine
NC_014634	Germany	1984	environmental-marine
NC_014641	Czech Republic	<2010	environmental-soil
NC_014642	Czech Republic	<2010	environmental-soil
NC_014651	USA	<2010	environmental-freshwater
NC_014653	Spain,Galicia	<2009	veterinary
NC_014718	ND	<2010	environmental-plant and algae
NC_014719	Iceland	2010	environmental-freshwater
NC_014723	ND	<2010	environmental-plant and algae
NC_014725	Korea	<2012	veterinary

NC_014726	Taiwan, Taipei	<2010	clinical potential
NC_014728	China	2011	environmental-food
NC_014749	Japan, Nagano, Yumata	<2010	environmental-freshwater
NC_014750	Viet Nam, Nha Trang	1969	environmental-soil
NC_014753	Pacific Ocean, East Pacific Rise	<2003	environmental-marine
NC_014754	Japan	<2004	environmental-wastewaters
NC_014755	Japan	<2004	environmental-wastewaters
NC_014756	Japan	<2004	environmental-wastewaters
NC_014757	Switzerland	2002	environmental-food
NC_014763	Japan	<2004	environmental-wastewaters
NC_014811	Greece	<2009	environmental-soil
NC_014812	Greece	<2009	environmental-soil
NC_014813	Milan, Italy	2008	clinical
NC_014818	ND	<2010	environmental-freshwater
NC_014819	ND	<2010	environmental-freshwater
NC_014824	USA	1951	environmental-animal
NC_014825	USA	1951	environmental-animal
NC_014826	USA	1951	environmental-animal
NC_014827	USA	1951	environmental-animal
NC_014832	ND	<2009	environmental-soil
NC_014838	ND	<2010	environmental-animal
NC_014839	ND	<2010	environmental-animal
NC_014840	ND	<2010	environmental-animal
NC_014841	ND	<2010	environmental-animal
NC_014842	ND	<2010	environmental-animal
NC_014843	Athens, Greece	2002	clinical
NC_014908	The Netherlands	2011	environmental-wastewaters
NC_014911	The Netherlands	2011	environmental-wastewaters
NC_014912	Poland	2001	clinical potential
NC_014913	ND	<2006	environmental-animal
NC_014916	USA	<2011	environmental-freshwater
NC_014917	Pacific Ocean	<2004	environmental-marine
NC_014918	Italy, 5 km before Bottida, Sardinia	1993	environmental-plant and algae
NC_014919	Thailand	<2010	environmental-food
NC_014936	ND	<2010	environmental-animal
NC_014937	China	2010	environmental-soil
NC_014957	USA, Oregon	<1987	environmental-plant and algae
NC_014959	USA	2002/8	clinical
NC_014975	South Africa	2011	environmental-freshwater
NC_015053	ND	<2008	environmental-human
NC_015054	Indonesia	<2012	clinical potential
NC_015055	Indonesia	<2012	clinical potential
NC_015056	Indonesia	<2012	clinical potential
NC_015057	Finland	<2011	environmental-soil
NC_015058	Finland	<2011	environmental-soil
NC_015059	Finland	<2011	environmental-soil
NC_015060	Finland	<2011	environmental-soil
NC_015062	USA	<2006	environmental-soil
NC_015063	USA	<2006	environmental-soil
NC_015065	Finland	<2011	environmental-soil
NC_015066	ND	<2008	environmental-human
NC_015068	Indonesia	<2012	clinical potential
NC_015146	Greece	2000	environmental-soil
NC_015147	Greece	2000	environmental-soil
NC_015148	ND	<2011	ND
NC_015149	ND	<2011	ND
NC_015154	China	2006	clinical
NC_015156	New Caledonia	2000	veterinary
NC_015162	ND	<2011	environmental-animal
NC_015163	ND	<2011	environmental-animal
NC_015165	Japan	<2011	environmental-animal
NC_015166	Japan	<2011	environmental-animal
NC_015168	Japan	<2011	environmental-animal
NC_015169	ND	<2011	environmental-animal
NC_015170	ND	<2011	environmental-animal

NC_015171	Germany,Mecklenburg-Western Pommerania	2005	veterinary
NC_015173	ND	<2010	clinical
NC_015175	ND	<2010	ND
NC_015176	ND	<2010	clinical
NC_015178	Japan	<2010	environmental-wastewaters
NC_015179	Japan	<2010	environmental-wastewaters
NC_015180	Japan	<2010	environmental-wastewaters
NC_015181	Japan	<2010	environmental-wastewaters
NC_015182	Japan	<2010	environmental-wastewaters
NC_015184	Hungary	1965	environmental-plant and algae
NC_015187	Japan	<2010	environmental-wastewaters
NC_015188	Japan	<2010	environmental-wastewaters
NC_015189	Japan	<2010	environmental-wastewaters
NC_015213	ND	<2011	environmental-animal
NC_015217	California,USA	1941	veterinary
NC_015218	ND	<2011	environmental-animal
NC_015219	Germany	2003	clinical
NC_015221	ND	1997	environmental-wastewaters
NC_015223	ND	1997	environmental-wastewaters
NC_015255	Toyama,Japan	2008	environmental-food
NC_015256	Toyama,Japan	1997	environmental-food
NC_015257	Toyama,Japan	2008	environmental-food
NC_015258	China	2011	environmental-soil
NC_015260	Toyama,Japan	2008	environmental-food
NC_015261	Toyama,Japan	2008	environmental-food
NC_015313	USA	<2005	environmental-wastewaters
NC_015314	USA	<2005	environmental-wastewaters
NC_015319	Finland, Helsinki	<2011	environmental-animal
NC_015322	Finland, Helsinki	<2011	environmental-animal
NC_015377	South Korea	2011	environmental-plant and algae
NC_015378	South Korea	2011	environmental-plant and algae
NC_015382	South Korea	2011	environmental-plant and algae
NC_015383	South Korea	2011	environmental-plant and algae
NC_015386	ND	<2011	environmental-animal
NC_015390	Norway, Isfjord, Spitsbergen	1999	environmental-marine
NC_015392	ND	<2011	veterinary
NC_015407	France	1995	veterinary
NC_015409	Japan	<2011	environmental-marine
NC_015417	Sweden	2008	veterinary
NC_015418	Sweden	2008	veterinary
NC_015419	Sweden	2008	veterinary
NC_015420	USA	<2008	environmental
NC_015421	USA	<2008	environmental
NC_015423	Germany	2011	environmental-wastewaters
NC_015426	Sweden	2008	veterinary
NC_015427	Sweden	2008	veterinary
NC_015429	USA	<2008	environmental
NC_015432	USA	2011	clinical
NC_015459	China	2011	environmental-marine
NC_015461	Iowa, USA	2011	veterinary
NC_015462	ND	<2011	ND
NC_015472	Australia	2001	clinical
NC_015473	China	<2011	environmental-plant and algae
NC_015475	China	2010	clinical
NC_015498	Japan	2011	environmental-marine
NC_015509	ND	<2010	environmental-soil
NC_015511	Netherlands	1970	environmental-wastewaters
NC_015512	Netherlands	1970	environmental-wastewaters
NC_015513	Netherlands	1970	environmental-wastewaters
NC_015515	ND	<2011	clinical
NC_015517	USA	<2011	veterinary
NC_015560	China	<2011	environmental-soil
NC_015561	China	<2011	environmental-soil
NC_015570	Georgia, USA	2005	veterinary
NC_015575	Georgia, USA	2005	veterinary

NC_015579	Italy	2011	environmental-marine
NC_015582	Italy	2011	environmental-marine
NC_015583	Italy	2011	environmental-marine
NC_015592	Italy	<2013	environmental-plant and algae
NC_015595	USA	<2011	environmental-freshwater
NC_015597	Italy	<2013	environmental-plant and algae
NC_015598	China	<2011	environmental-food
NC_015599	Bristol, UK	2001	environmental-animal
NC_015603	China	<2011	environmental-food
NC_015657	ND	<2011	environmental-plant and algae
NC_015661	USA	<2011	environmental-freshwater
NC_015664	ND	<2011	environmental-plant and algae
NC_015665	USA	<2011	environmental-freshwater
NC_015670	ND	<2011	clinical
NC_015679	USA	<2011	environmental-animal
NC_015685	Germany	1978	environmental-wastewaters
NC_015686	ND	<2011	clinical
NC_015688	ND	<2011	clinical
NC_015689	Göttingen, Germany	1978	environmental-wastewaters
NC_015693	USA	1978	environmental-freshwater
NC_015694	USA	1978	environmental-freshwater
NC_015695	USA	1978	environmental-freshwater
NC_015698	Peru	1990	environmental-human
NC_015699	Peru	1990	environmental-human
NC_015700	Peru	1990	environmental-human
NC_015701	Peru	1990	environmental-human
NC_015704	USA	1978	environmental-freshwater
NC_015705	USA	1978	environmental-freshwater
NC_015708	Japan,Shizuoka	<2011	environmental-marine
NC_015710	Beersheba, Israel	<2011	clinical potential
NC_015712	Japan	<2011	environmental-food
NC_015715	United Kingdom	<2011	environmental-food
NC_015716	United Kingdom	<2011	environmental-food
NC_015724	USA, University Park, PA	<1987	environmental-soil
NC_015727	USA, University Park, PA	<1987	environmental-soil
NC_015728	ND	<2007	environmental-plant and algae
NC_015729	ND	<2007	environmental-plant and algae
NC_015739	ND	<2010	clinical
NC_015741	ND	<2007	environmental-plant and algae
NC_015742	Spain	1999	environmental-plant and algae
NC_015756	ND	<2011	environmental-food
NC_015845	Switzerland	<2010	environmental-animal
NC_015849	Rajasthan, India	<2011	environmental-animal
NC_015851	Beijing, China	<2011	environmental
NC_015852	Beijing, China	<2011	environmental
NC_015853	Beijing, China	<2011	environmental
NC_015854	Beijing, China	<2011	environmental
NC_015855	Granada, Spain	<2000	environmental-wastewaters
NC_015860	France	<2010	environmental-food
NC_015861	France	<2010	environmental-food
NC_015862	France	<2010	environmental-food
NC_015863	France	<2010	environmental-food
NC_015864	France	<2010	environmental-food
NC_015872	New York, USA	<2011	clinical
NC_015876	Switzerland	<2011	clinical
NC_015900	ND	<2011	environmental-food
NC_015901	ND	<2011	environmental-food
NC_015902	ND	<2011	environmental-food
NC_015903	USA, California	<2011	clinical
NC_015904	USA, California	<2011	clinical
NC_015905	USA, California	<2011	clinical
NC_015906	USA, California	<2011	clinical
NC_015907	USA, California	<2011	clinical
NC_015908	USA, California	<2011	clinical
NC_015909	USA, California	<2011	clinical

NC_015910	USA, California	<2011	clinical
NC_015911	USA, California	<2011	clinical
NC_015912	ND	<2011	environmental-food
NC_015915	USA, California	<2011	clinical
NC_015916	USA, California	<2011	clinical
NC_015917	USA, California	<2011	clinical
NC_015918	USA, California	<2011	clinical
NC_015919	USA, California	<2011	clinical
NC_015920	USA, California	<2011	clinical
NC_015922	USA, California	<2011	clinical
NC_015950	Taiwan	1999/2009	veterinary
NC_015951	ND	<2011	environmental-soil
NC_015952	ND	<2011	environmental-soil
NC_015956	Taiwan	1999/2009	veterinary
NC_015963	ND	<2011	ND
NC_015965	ND	<2010	ND
NC_015967	ND	<2011	environmental-marine
NC_015969	ND	<2011	ND
NC_015970	ND	<2011	environmental-marine
NC_015971	USA	2005/9	clinical
NC_015972	Ural, Russia	<2010	environmental
NC_015973	USA	2005/9	clinical
NC_015974	Yamaguchi, Japan	1986	environmental-freshwater
NC_015979	ND	<2010	environmental-food
NC_015980	ND	<2010	environmental-food
NC_016000	ND	<2011	environmental-freshwater
NC_016009	USA	2011	environmental-food
NC_016021	Japan	<2011	environmental-food
NC_016022	Japan	<2011	environmental-food
NC_016028	Japan	<2011	environmental-food
NC_016029	Japan	<2011	environmental-food
NC_016030	Japan	<2011	environmental-food
NC_016034	Austria	<2011	environmental-food
NC_016035	Austria	<2011	environmental-food
NC_016036	USA,New Haven	1972	ND
NC_016037	Japan	<2011	environmental-food
NC_016039	Hong Kong, China	2008	environmental-animal
NC_016040	USA; Caribbean	2003	environmental-freshwater
NC_016042	ND	<2011	environmental-food
NC_016045	Slovakia	<2012	environmental-animal
NC_016046	Japan	2007	environmental-animal
NC_016053	Italy	1989	environmental-plant and algae
NC_016054	China	<2013	environmental-animal
NC_016079	China	2011	environmental-marine
NC_016108	Tuva, Russia	<2011	environmental-marine
NC_016110	USA	<2011	environmental-soil
NC_016113	New Jersey, USA	<2011	environmental-soil
NC_016115	USA	<2011	environmental-soil
NC_016137	Denmark	<2008	veterinary
NC_016138	Mexico	<2014	clinical
NC_016139	Denmark	<2008	veterinary
NC_016140	Denmark	<2008	veterinary
NC_016149	Norway	<2011	environmental-freshwater
NC_016150	Australia	<2011	environmental-animal
NC_016151	Montpellier, France	1928	clinical
NC_016515	ND	<2011	environmental-plant and algae
NC_016583	Poland	2009	environmental-plant and algae
NC_016585	ND	<2011	environmental-soil
NC_016586	ND	<2011	environmental-soil
NC_016587	ND	<2011	environmental-soil
NC_016588	ND	<2011	environmental-soil
NC_016591	ND	<2011	environmental-soil
NC_016592	ND	<2011	environmental-soil
NC_016594	ND	<2011	environmental-soil
NC_016595	ND	<2011	environmental-soil

NC_016596	ND	<2011	environmental-soil
NC_016597	ND	<2011	environmental-soil
NC_016598	USA	<2011	environmental-animal
NC_016600	USA	<2005	environmental-wastewaters
NC_016601	USA	<2005	environmental-wastewaters
NC_016606	ND	<2011	environmental-food
NC_016607	ND	<2011	environmental-food
NC_016608	ND	<2011	environmental-food
NC_016611	South Korea	<2012	veterinary
NC_016615	ND	<2010	environmental-soil
NC_016618	ND	<2011	environmental-soil
NC_016619	ND	<2011	environmental-soil
NC_016623	ND	<2011	environmental-soil
NC_016624	ND	<2011	environmental-soil
NC_016626	ND	<2011	environmental-soil
NC_016634	Malaysia	<2011	environmental-freshwater
NC_016635	ND	<2011	environmental-food
NC_016636	ND	<2011	environmental-food
NC_016643	California,USA	<2012	clinical
NC_016644	Antarctica, King George Island	<2013	environmental-wastewaters
NC_016646	USA, Florida	<2013	environmental-animal
NC_016746	Iran	<2011	environmental-soil
NC_016747	Iran	<2011	environmental-soil
NC_016748	Pacific Ocean	2002	environmental-marine
NC_016750	ND	<2011	environmental-food
NC_016772	ND	<2004	clinical
NC_016773	ND	<2004	clinical
NC_016774	ND	<2004	clinical
NC_016780	ND	1976	clinical
NC_016792	ND	<2004	clinical
NC_016793	ND	<2004	clinical
NC_016794	ND	1976	clinical
NC_016806	ND	<2011	environmental-food
NC_016813	China	<2012	environmental-soil
NC_016814	China	<2012	environmental-soil
NC_016815	China	<2012	environmental-soil
NC_016817	Georgia	<2012	clinical
NC_016819	France	<2012	environmental-freshwater
NC_016820	ND	<2011	environmental-food
NC_016821	ND	<2011	environmental-food
NC_016823	ND	<2011	clinical
NC_016824	ND	<2012	clinical
NC_016825	India	<2012	clinical
NC_016827	ND	<2011	environmental-food
NC_016828	ND	<2011	environmental-food
NC_016833	ND	<2011	clinical
NC_016834	ND	<2012	clinical
NC_016835	France	<2012	environmental-freshwater
NC_016836	China	<2012	environmental-soil
NC_016837	Kenya	2008	environmental-food
NC_016838	Shanghai, China	2011	clinical
NC_016839	Shanghai, China	2011	clinical
NC_016840	Shanghai, China	2011	clinical
NC_016841	Shanghai, China	2011	clinical
NC_016846	Shanghai, China	2011	clinical
NC_016847	Shanghai, China	2011	clinical
NC_016849	South Korea	<2012	veterinary
NC_016850	ND	<2011	veterinary
NC_016851	USA, Hawaii	2005	veterinary
NC_016852	South Korea	<2012	veterinary
NC_016853	ND	<2011	veterinary
NC_016855	ND	1960	veterinary
NC_016858	United Kingdom	<2011	veterinary
NC_016859	United Kingdom	<2011	veterinary
NC_016861	Japan	2000	clinical

NC_016862	Japan	2000	clinical
NC_016864	ND	1991	veterinary
NC_016900	Japan	<2011	environmental-food
NC_016903	ND	<2011	ND
NC_016904	ND	<2011	ND
NC_016905	Gotland Deep, Central Baltic Sea	<2010	environmental-marine
NC_016907	ND	<2011	clinical
NC_016936	California,USA	<2012	environmental-marine
NC_016939	ND	<2012	ND
NC_016942	Australia	2006	clinical
NC_016966	ND	<2011	clinical
NC_016967	China, Beijing	2004	clinical
NC_016968	California,USA	<2002	environmental-wastewaters
NC_016969	ND	<2012	clinical
NC_016970	ND	<2012	clinical
NC_016971	ND	<2012	clinical
NC_016972	Jinggang Mountain, China	1974	ND
NC_016973	USA	1998	veterinary
NC_016974	Afghanistan	2011	clinical
NC_016975	ND	<2011	environmental-animal
NC_016976	France	1969	clinical
NC_016977	ND	<2011	environmental-soil
NC_016978	California,USA	<2011	environmental-soil
NC_016979	ND	<2012	clinical
NC_016980	Rabat, Morocco	<2012	clinical
NC_016981	ND	<2012	clinical
NC_016982	ND	<2012	clinical
NC_016983	Japan, Kagawa	<2006	environmental-marine
NC_017017	ND	<2011	environmental-food
NC_017018	ND	<2011	environmental-food
NC_017019	ND	<2011	environmental-food
NC_017020	ND	<2012	clinical potential
NC_017021	ND	<2012	clinical potential
NC_017023	Australia, Melbourne	1998	clinical
NC_017024	Australia, Melbourne	1998	clinical
NC_017029	ND	<2012	clinical potential
NC_017032	Australia, Melbourne	1998	clinical
NC_017035	China	<2012	veterinary
NC_017041	ND	<2012	ND
NC_017054	USA	<2012	veterinary
NC_017055	ND	<2012	ND
NC_017060	Beijing, China	<2012	environmental-soil
NC_017064	El Salvador, rural region	<2011	clinical
NC_017069	ND	<2011	environmental-animal
NC_017070	ND	<2011	environmental-animal
NC_017071	ND	<2011	environmental-animal
NC_017072	ND	<2011	environmental-animal
NC_017073	ND	<2011	environmental-animal
NC_017074	ND	<2011	environmental-animal
NC_017076	ND	<2011	environmental-animal
NC_017077	ND	<2011	environmental-animal
NC_017078	ND	<2011	environmental-animal
NC_017081	Mikura Island, Japan	2007	environmental-plant and algae
NC_017092	Lille, France	<2012	environmental-freshwater
NC_017097	France,Limoges	2009	environmental-wastewaters
NC_017101	Japan	<2009	environmental-food
NC_017102	Japan	<2009	environmental-food
NC_017103	Japan	<2009	environmental-food
NC_017104	Japan	<2009	environmental-food
NC_017105	Japan	<2009	environmental-food
NC_017106	Japan	<2009	environmental-food
NC_017107	Japan	<2009	environmental-food
NC_017109	Japan	<2009	environmental-food
NC_017110	Japan	<2009	environmental-food
NC_017112	Japan	<2009	environmental-food

NC_017113	Japan	<2009	environmental-food
NC_017114	Japan	<2009	environmental-food
NC_017115	Japan	<2009	environmental-food
NC_017116	Japan	<2009	environmental-food
NC_017117	Japan	<2009	environmental-food
NC_017118	Japan	<2009	environmental-food
NC_017119	Japan	<2009	environmental-food
NC_017120	Japan	<2009	environmental-food
NC_017122	Japan	<2009	environmental-food
NC_017123	Japan	<2009	environmental-food
NC_017124	Japan	<2009	environmental-food
NC_017126	Japan	<2009	environmental-food
NC_017127	Japan	<2009	environmental-food
NC_017128	Japan	<2009	environmental-food
NC_017129	Japan	<2009	environmental-food
NC_017130	Japan	<2009	environmental-food
NC_017131	Japan	<2009	environmental-food
NC_017132	Japan	<2009	environmental-food
NC_017133	Japan	<2009	environmental-food
NC_017134	Japan	<2009	environmental-food
NC_017135	Japan	<2009	environmental-food
NC_017136	Japan	<2009	environmental-food
NC_017137	Japan	<2009	environmental-food
NC_017139	Jiangsu, China	<2011	environmental
NC_017140	Jiangsu, China	<2011	environmental
NC_017141	Jiangsu, China	<2011	environmental
NC_017142	Japan	<2009	environmental-food
NC_017143	Japan	<2009	environmental-food
NC_017144	Japan	<2009	environmental-food
NC_017145	Japan	<2009	environmental-food
NC_017147	Japan	<2009	environmental-food
NC_017148	Japan	<2009	environmental-food
NC_017149	Japan	<2009	environmental-food
NC_017151	Japan	<2009	environmental-food
NC_017152	Japan	<2009	environmental-food
NC_017153	China	2006	clinical potential
NC_017155	China	2006	clinical potential
NC_017156	China	2006	clinical potential
NC_017157	China	1982	clinical potential
NC_017158	China	1982	clinical potential
NC_017159	China	1982	clinical potential
NC_017163	South Korea	<2011	clinical
NC_017164	South Korea	<2011	clinical
NC_017169	ND	<2011	clinical
NC_017170	ND	<2011	clinical
NC_017172	China, Zheijiang	2006	clinical
NC_017180	Mexico	1929	environmental-food
NC_017181	Mexico	1929	environmental-food
NC_017182	Mexico	1929	environmental-food
NC_017183	Mexico	1929	environmental-food
NC_017184	Mexico	1929	environmental-food
NC_017185	Mexico	1929	environmental-food
NC_017189	ND	<2011	environmental-food
NC_017193	United Kingdom, Edinburgh	<2011	environmental
NC_017194	ND	<2009	ND
NC_017197	ND	<2005	environmental
NC_017199	China	<2011	environmental
NC_017201	China	<2012	environmental
NC_017202	Hubei, China	<2011	environmental-soil
NC_017203	Hubei, China	<2011	environmental-soil
NC_017204	Hubei, China	<2011	environmental-soil
NC_017205	Hubei, China	<2011	environmental-soil
NC_017206	Hubei, China	<2011	environmental-soil
NC_017207	Hubei, China	<2011	environmental-soil
NC_017209	Hubei, China	<2011	environmental-soil

NC_017210	Hubei, China	<2011	environmental-soil
NC_017211	Hubei, China	<2011	environmental-soil
NC_017212	Hubei, China	<2011	environmental-soil
NC_017213	ND	<2005	ND
NC_017220	Korea	<2011	environmental-human
NC_017222	Korea	<2011	environmental-human
NC_017224	Germany	<2011	clinical
NC_017225	Germany	<2011	clinical
NC_017226	Germany	<2011	clinical
NC_017227	Germany	<2011	clinical
NC_017228	Germany	<2011	clinical
NC_017229	Germany	<2011	clinical
NC_017230	Germany	<2011	clinical
NC_017231	Germany	<2011	clinical
NC_017232	Germany	<2011	clinical
NC_017233	Germany	<2011	clinical
NC_017234	Germany	<2011	clinical
NC_017235	Germany	<2011	clinical
NC_017236	Germany	<2011	clinical
NC_017237	Germany	<2011	clinical
NC_017239	Germany	<2011	clinical
NC_017240	Germany	<2011	clinical
NC_017241	Germany	<2011	clinical
NC_017242	England	<2011	veterinary
NC_017257	Arizona, USA	2007	environmental-plant and algae
NC_017258	Arizona, USA	2008	environmental-plant and algae
NC_017260	Arizona, USA	2009	environmental-plant and algae
NC_017261	Arizona, USA	2010	environmental-plant and algae
NC_017263	China	<2011	clinical
NC_017264	China	<2011	clinical
NC_017266	China	<2011	clinical
NC_017273	ND	<2011	ND
NC_017282	ND	<2010	veterinary
NC_017284	Iowa, USA	<2011	veterinary
NC_017286	ND	<2009	veterinary
NC_017288	ND	1929/30	veterinary
NC_017296	China	<2011	environmental-soil
NC_017298	Japan	2006/11	clinical
NC_017311	Washington, USA	2007	environmental-freshwater
NC_017318	ND	<2010	environmental-animal
NC_017319	China	<2009	clinical
NC_017320	China	<2009	clinical
NC_017321	China	<2009	clinical
NC_017323	Italy	<2013	environmental-plant and algae
NC_017324	Italy	<2013	environmental-plant and algae
NC_017326	Germany	<2010	environmental-plant and algae
NC_017327	Germany	<2010	environmental-plant and algae
NC_017329	China	<2009	clinical
NC_017330	China	<2009	clinical
NC_017332	London, UK	2003	clinical
NC_017334	ND	<2008	clinical
NC_017335	ND	<2008	clinical
NC_017336	ND	<2008	clinical
NC_017339	Australia	<2010	clinical
NC_017344	Sweden, Linkoping	2005	clinical
NC_017345	ND	<2010	clinical
NC_017346	Sweden, Linkoping	2005	clinical
NC_017348	United Kingdom	2007	environmental-food
NC_017350	Denmark	1997	clinical
NC_017352	London, UK	<2009	clinical
NC_017356	Peru, Satipo region	<2010	clinical
NC_017363	ND	<2010	clinical
NC_017364	ND	<2010	clinical
NC_017369	ND	<2010	clinical
NC_017370	ND	<2010	clinical

NC_017373	ND	<2010	clinical
NC_017377	Peru, Puno region	<2011	clinical
NC_017380	West Bengal, India	<2011	clinical potential
NC_017383	ND	<2009	clinical
NC_017385	Jiangnan, China	<2011	environmental-soil
NC_017386	Jiangnan, China	<2011	environmental-soil
NC_017388	South Korea	<2010	environmental-plant and algae
NC_017389	South Korea	<2010	environmental-plant and algae
NC_017391	South Korea	<2010	environmental-plant and algae
NC_017392	South Korea	<2010	environmental-plant and algae
NC_017393	Massachusetts, USA	<2010	clinical potential
NC_017394	Massachusetts, USA	<2010	clinical potential
NC_017395	Massachusetts, USA	<2010	clinical potential
NC_017396	Massachusetts, USA	<2010	clinical potential
NC_017397	Massachusetts, USA	<2010	clinical potential
NC_017398	New York, USA	<2010	clinical potential
NC_017399	New York, USA	<2010	clinical potential
NC_017400	New York, USA	<2010	clinical potential
NC_017401	New York, USA	<2010	clinical potential
NC_017402	New York, USA	<2010	clinical potential
NC_017404	Massachusetts, USA	<2010	clinical potential
NC_017405	Massachusetts, USA	<2010	clinical potential
NC_017406	Massachusetts, USA	<2010	clinical potential
NC_017407	Massachusetts, USA	<2010	clinical potential
NC_017408	Massachusetts, USA	<2010	clinical potential
NC_017409	Massachusetts, USA	<2010	clinical potential
NC_017410	Massachusetts, USA	<2010	clinical potential
NC_017411	Massachusetts, USA	<2010	clinical potential
NC_017412	Massachusetts, USA	<2010	clinical potential
NC_017413	Massachusetts, USA	<2010	clinical potential
NC_017414	New York, USA	<2010	clinical potential
NC_017415	New York, USA	<2010	clinical potential
NC_017416	New York, USA	<2010	clinical potential
NC_017417	New York, USA	<2010	clinical potential
NC_017419	New York, USA	<2010	clinical potential
NC_017420	New York, USA	<2010	clinical potential
NC_017421	New York, USA	<2010	clinical potential
NC_017422	New York, USA	<2010	clinical potential
NC_017423	New York, USA	<2010	clinical potential
NC_017424	New York, USA	<2010	clinical potential
NC_017425	Massachusetts, USA	<2010	clinical potential
NC_017426	Massachusetts, USA	<2010	clinical potential
NC_017427	Massachusetts, USA	<2010	clinical potential
NC_017428	Massachusetts, USA	<2010	clinical potential
NC_017433	ND	<2010	veterinary
NC_017435	ND	<2010	veterinary
NC_017438	ND	<2010	veterinary
NC_017442	Japan	1970s	environmental-plant and algae
NC_017443	Japan	1970s	environmental-plant and algae
NC_017444	Japan	1970s	environmental-plant and algae
NC_017446	Japan	1970s	environmental-plant and algae
NC_017447	Japan	1970s	environmental-plant and algae
NC_017466	ND	<2010	environmental-animal
NC_017468	Tibet, China	<2010	environmental-food
NC_017471	ND	<2011	environmental-animal
NC_017472	ND	<2011	environmental-animal
NC_017475	China, Inner Mongolia	<2011	environmental-food
NC_017476	China	<2011	environmental-food
NC_017478	ND	<2005	environmental-food
NC_017479	Madrid, Spain	<2006	environmental-human
NC_017480	Madrid, Spain	<2006	environmental-human
NC_017483	Beijing, China	<2011	environmental-human
NC_017484	Beijing, China	<2011	environmental-human
NC_017485	Beijing, China	<2011	environmental-human
NC_017487	Beijing, China	<2011	environmental-human

NC_017488	Beijing, China	<2011	environmental-human
NC_017489	France	<2010	environmental-food
NC_017493	ND	<2011	environmental-food
NC_017494	ND	<1998	environmental-food
NC_017495	ND	<2011	environmental-food
NC_017496	ND	<2011	environmental-food
NC_017497	ND	<2011	environmental-food
NC_017498	ND	<2005	environmental-food
NC_017499	Madrid, Spain	<2006	environmental-human
NC_017500	ND	<2005	environmental-food
NC_017507	Germany	2000	environmental-marine
NC_017508	Germany	2000	environmental-marine
NC_017533	Shizuoka, Japan	1995	environmental-soil
NC_017536	Göttingen, Germany	1978	environmental-wastewaters
NC_017539	Göttingen, Germany	1978	environmental-wastewaters
NC_017541	ND	<2011	clinical
NC_017543	ND	<2011	environmental-plant and algae
NC_017553	ND	<2011	environmental-plant and algae
NC_017555	France	<2009	environmental-plant and algae
NC_017556	France	<2009	environmental-plant and algae
NC_017557	France	<2009	environmental-plant and algae
NC_017558	Cameroon	<2010	environmental-plant and algae
NC_017561	Texas, USA	<2010	environmental-plant and algae
NC_017565	Germany	<2000	clinical
NC_017570	Gotland Deep, Central Baltic Sea	1998	environmental-marine
NC_017572	Gotland Deep, Central Baltic Sea	1998	environmental-marine
NC_017575	Mexico	<2011	environmental-plant and algae
NC_017577	Gotland Deep, Central Baltic Sea	<2011	environmental-marine
NC_017578	Gotland Deep, Central Baltic Sea	<2011	environmental-marine
NC_017580	Gotland Deep, Central Baltic Sea	<2011	environmental-marine
NC_017585	Japan	<2011	environmental-soil
NC_017588	Nevada, USA	<2012	environmental-freshwater
NC_017589	Cameroon	<2010	environmental-plant and algae
NC_017590	Nevada, USA	<2012	environmental-freshwater
NC_017624	France	<2012	veterinary
NC_017627	Lima, Peru	1983	clinical
NC_017629	ND	<2009	clinical
NC_017630	ND	<2010	clinical
NC_017636	New Jersey, USA	1943	environmental-soil
NC_017637	New Jersey, USA	1943	environmental-soil
NC_017639	USA	2007	veterinary
NC_017640	USA	2007	veterinary
NC_017642	USA	2007	veterinary
NC_017643	USA	2007	veterinary
NC_017645	USA	2007	veterinary
NC_017647	USA	<2011	clinical
NC_017648	USA	<2011	clinical
NC_017649	USA	<2011	clinical
NC_017650	USA	<2011	clinical
NC_017653	USA, California	1974	clinical
NC_017654	USA, California	1974	clinical
NC_017655	USA, California	1974	clinical
NC_017657	USA, California	1974	clinical
NC_017658	USA, California	1974	clinical
NC_017659	Germany	<2008	clinical
NC_017661	ND	<2010	environmental
NC_017662	ND	<2011	environmental
NC_017665	ND	<2012	environmental
NC_017669	Germany	<2013	environmental-soil
NC_017670	Germany	<2013	environmental-soil
NC_017675	United Kingdom	<2011	veterinary
NC_017718	ND	<2012	veterinary
NC_017719	ND	<2012	veterinary
NC_017720	ND	<2012	veterinary
NC_017721	Dacca, Bangladesh	1973	clinical

NC_017722	Dacca, Bangladesh	1973	clinical
NC_017723	Dacca, Bangladesh	1973	clinical
NC_017724	Dacca, Bangladesh	1973	clinical
NC_017725	Russia, Tomsk region	<2012	clinical potential
NC_017726	South Korea	1994	clinical
NC_017727	South Korea	1994	clinical
NC_017734	Spain	<2012	clinical
NC_017736	CT, USA	<2002	veterinary
NC_017738	CT, USA	<2002	veterinary
NC_017762	ND	<2012	clinical
NC_017766	Jiangxi, China	1974	environmental-soil
NC_017767	Japan	<2012	environmental-freshwater
NC_017771	China	2009	environmental-soil
NC_017772	USA	<2005	environmental-wastewaters
NC_017773	Beijing, China	<2012	environmental-soil
NC_017774	Mauritania	<2012	clinical potential
NC_017775	Mauritania	<2012	clinical potential
NC_017776	Mauritania	<2012	clinical potential
NC_017777	Mauritania	<2012	clinical potential
NC_017778	Mauritania	<2012	clinical potential
NC_017779	Mauritania	<2012	clinical potential
NC_017780	Mauritania	<2012	clinical potential
NC_017781	Mauritania	<2012	clinical potential
NC_017782	Mauritania	<2012	clinical potential
NC_017783	Mauritania	<2012	clinical potential
NC_017784	Mauritania	<2012	clinical potential
NC_017785	Mauritania	<2012	clinical potential
NC_017786	Mauritania	<2012	clinical potential
NC_017787	Mauritania	<2012	clinical potential
NC_017788	Mauritania	<2012	clinical potential
NC_017789	Mauritania	<2012	clinical potential
NC_017791	China	2009	environmental-soil
NC_017792	China	2009	environmental-soil
NC_017793	China	2009	environmental-soil
NC_017794	Mauritania	<2012	clinical potential
NC_017795	Mauritania	<2012	clinical potential
NC_017796	Mauritania	<2012	clinical potential
NC_017797	Mauritania	<2012	clinical potential
NC_017798	Mauritania	<2012	clinical potential
NC_017799	Mauritania	<2012	clinical potential
NC_017800	Mauritania	<2012	clinical potential
NC_017801	Mauritania	<2012	clinical potential
NC_017802	Mauritania	<2012	clinical potential
NC_017804	Russia, Tomsk region	<2012	clinical potential
NC_017805	China	2009	environmental-soil
NC_017806	China	2009	environmental-soil
NC_017807	Beijing, China	<2012	environmental-soil
NC_017809	Mauritania	<2012	clinical potential
NC_017810	Mauritania	<2012	clinical potential
NC_017811	Mauritania	<2012	clinical potential
NC_017812	Mauritania	<2012	clinical potential
NC_017813	Mauritania	<2012	clinical potential
NC_017814	Mauritania	<2012	clinical potential
NC_017815	Mauritania	<2012	clinical potential
NC_017816	Mauritania	<2012	clinical potential
NC_017817	Mauritania	<2012	clinical potential
NC_017818	Mauritania	<2012	clinical potential
NC_017819	Mauritania	<2012	clinical potential
NC_017820	Mauritania	<2012	clinical potential
NC_017821	Mauritania	<2012	clinical potential
NC_017822	Mauritania	<2012	clinical potential
NC_017833	Hunan, China	<2006	environmental-soil
NC_017848	China	2011	clinical
NC_017858	Montreal, Canada	2013	environmental-wastewaters
NC_017903	China	1999	clinical

NC_017907	China	1999	clinical
NC_017908	Brazil	2007	clinical
NC_017919	China	<2012	clinical
NC_017923	ND	<2012	environmental-plant and algae
NC_017925	ND	<2012	environmental-animal
NC_017935	USA	<2012	environmental-estuarine
NC_017957	Red Sea	<2012	environmental-marine
NC_017958	Red Sea	<2012	environmental-marine
NC_017959	Red Sea	<2012	environmental-marine
NC_017961	USA, Texas	<2012	clinical
NC_017962	USA, Texas	<2012	clinical
NC_017963	USA, Texas	<2012	clinical
NC_017965	ND	<2011	environmental-wastewaters
NC_017966	Red Sea	<2011	environmental-marine
NC_018021	Canada	1981	environmental
NC_018022	ND	<2012	environmental-soil
NC_018023	ND	<2012	environmental-soil
NC_018026	USA	<2012	environmental-wastewaters
NC_018066	France	2010	environmental-wastewaters
NC_018067	France	2010	environmental-wastewaters
NC_018069	Japan	<2011	environmental-plant and algae
NC_018107	Taiwan	2010	clinical
NC_018141	Philadelphia, USA	1976	clinical
NC_018146	Congo	<2012	environmental-food
NC_018147	Congo	<2012	environmental-food
NC_018148	Congo	<2012	environmental-food
NC_018222	Denmark	2001	environmental-animal
NC_018223	Denmark	2001	environmental-animal
NC_018265	Japan	<2011	veterinary
NC_018287	Spain	<2007	environmental-animal
NC_018288	Spain	<2007	environmental-animal
NC_018291	Spain	<2007	environmental-animal
NC_018421	Sydney, Australia	<2007	environmental-plant and algae
NC_018422	Sydney, Australia	<2007	environmental-plant and algae
NC_018423	Sydney, Australia	<2007	environmental-plant and algae
NC_018486	USA	<2012	environmental-soil
NC_018487	USA	<2012	environmental-soil
NC_018488	USA	<2012	environmental-soil
NC_018489	USA	<2012	environmental-soil
NC_018490	USA	<2012	environmental-soil
NC_018492	ND	<2012	ND
NC_018493	ND	<2012	ND
NC_018494	ND	<2012	ND
NC_018499	ND	<2012	ND
NC_018501	USA	<2012	environmental-soil
NC_018502	USA	<2012	environmental-soil
NC_018503	USA	<2012	environmental-soil
NC_018509	USA	<2013	environmental-soil
NC_018510	USA	<2013	environmental-soil
NC_018511	USA	<2013	environmental-soil
NC_018512	USA	<2013	environmental-soil
NC_018516	USA	<2013	environmental-soil
NC_018517	USA	<2013	environmental-soil
NC_018532	Castrop-Rauxel, Germany	<2012	environmental-wastewaters
NC_018580	China	2005	environmental-soil
NC_018582	China	2005	environmental-soil
NC_018583	China	2005	environmental-soil
NC_018606	Weslaco, Texas	2006	environmental-animal
NC_018611	Austria	2012	environmental-food
NC_018633	Germany	<2012	veterinary
NC_018634	USA	1957	veterinary
NC_018635	Saskatchewan, Canada	1961	veterinary
NC_018636	USA	1934	clinical
NC_018637	USA	1954	veterinary
NC_018638	USA	1991	veterinary

NC_018639	Argentina	2011	clinical
NC_018640	Germany	2001	veterinary
NC_018651	Republic of Georgia	2009	clinical
NC_018652	Republic of Georgia	2009	clinical
NC_018653	Pacific	1965	environmental-marine
NC_018654	Republic of Georgia	2009	clinical
NC_018657	Berkeley, Califórnia, USA	1942	environmental-soil
NC_018659	USA	2011	clinical
NC_018660	USA	2011	clinical
NC_018662	Republic of Georgia	2009	clinical
NC_018663	Republic of Georgia	2009	clinical
NC_018666	USA	2011	clinical
NC_018674	South Korea	<2012	environmental-food
NC_018675	South Korea	<2012	environmental-food
NC_018680	Valencia, Spain	<2012	environmental-marine
NC_018682	Hungary	1977	environmental-plant and algae
NC_018683	Hungary	1977	environmental-plant and algae
NC_018684	Sichuan Province, China	<2009	environmental-soil
NC_018685	Sichuan Province, China	<2009	environmental-soil
NC_018686	Sichuan Province, China	<2009	environmental-soil
NC_018687	Sichuan Province, China	<2009	environmental-soil
NC_018688	Sichuan Province, China	<2009	environmental-soil
NC_018689	Sichuan Province, China	<2009	environmental-soil
NC_018694	Sichuan Province, China	<2009	environmental-soil
NC_018696	South America	<2012	environmental-plant and algae
NC_018698	South Korea	<2012	environmental-food
NC_018699	South Korea	<2012	environmental-food
NC_018701	Hungary	1977	environmental-plant and algae
NC_018742	India, Assam, Jorhat	<2011	environmental-freshwater
NC_018743	India, Assam, Jorhat	<2011	environmental-freshwater
NC_018744	India, Assam, Jorhat	<2011	environmental-freshwater
NC_018745	India, Assam, Jorhat	<2011	environmental-freshwater
NC_018746	Tianjin, China	<2000	environmental-wastewaters
NC_018749	India, Assam, Jorhat	<2011	environmental-freshwater
NC_018751	Hungary	1983	veterinary
NC_018830	New Zealand	<2012	veterinary
NC_018878	Guyancourt, France	1989	environmental-soil
NC_018879	Guyancourt, France	1989	environmental-soil
NC_018880	Guyancourt, France	1989	environmental-soil
NC_018881	Guyancourt, France	1989	environmental-soil
NC_018882	Guyancourt, France	1989	environmental-soil
NC_018883	Guyancourt, France	1989	environmental-soil
NC_018884	Guyancourt, France	1989	environmental-soil
NC_018885	Guyancourt, France	1989	environmental-soil
NC_018886	Guyancourt, France	1989	environmental-soil
NC_018888	Germany	1966	clinical
NC_018889	United Kingdom	1935	clinical
NC_018952	Australia,	1995	clinical potential
NC_018953	Warsaw, Poland	<2005	clinical
NC_018954	USA	<2010	veterinary
NC_018956	Georgia, USA	<2010	clinical
NC_018957	Colorado, USA	<2010	clinical
NC_018958	Colorado, USA	<2010	clinical
NC_018959	New York, USA	<2010	clinical
NC_018960	New York, USA	<2010	clinical
NC_018961	Minnesota, USA	<2010	clinical
NC_018963	Pennsylvania, USA	<2010	clinical
NC_018965	USA	1982	clinical potential
NC_018966	USA	<2010	veterinary
NC_018967	Tennessee, USA	<2010	clinical
NC_018968	Tennessee, USA	<2010	clinical
NC_018969	Oregon, USA	<2010	clinical
NC_018972	Australia, remote Western Australia	2001	clinical
NC_018974	California, USA	<2010	clinical
NC_018975	California, USA	<2010	clinical

NC_018976	Oregon, USA	<2010	clinical
NC_018977	Illinois, USA	<2010	environmental-plant and algae
NC_018978	Illinois, USA	<2010	environmental-plant and algae
NC_018979	Connecticut, USA	<2010	clinical
NC_018980	Connecticut, USA	<2010	clinical
NC_018981	Connecticut, USA	<2010	clinical
NC_018982	Connecticut, USA	<2010	clinical
NC_018983	Connecticut, USA	<2010	clinical
NC_018984	Connecticut, USA	<2010	clinical
NC_018985	Illinois, USA	<2010	environmental-plant and algae
NC_018986	Connecticut, USA	<2010	clinical
NC_018987	Connecticut, USA	<2010	clinical
NC_018988	Connecticut, USA	<2010	clinical
NC_018989	Connecticut, USA	<2010	clinical
NC_018990	Connecticut, USA	<2010	clinical
NC_018991	Connecticut, USA	<2010	clinical
NC_018992	Connecticut, USA	<2010	clinical
NC_018993	Connecticut, USA	<2010	clinical
NC_018994	Japan	2009	clinical
NC_018995	Germany	2001	clinical
NC_018996	Germany	2001	clinical
NC_018997	Germany	2001	clinical
NC_018998	Hungary	<2007	veterinary
NC_018999	Fribourg, Switzerland	2007	environmental-plant and algae
NC_019000	Germany	2001	clinical
NC_019001	Japan,Hokkaido	<2010	veterinary
NC_019002	United Kingdom	1991	veterinary
NC_019003	Connecticut, USA	<2010	clinical
NC_019004	Connecticut, USA	<2010	clinical
NC_019005	Connecticut, USA	<2010	clinical
NC_019006	Connecticut, USA	<2010	clinical
NC_019007	USA	<2009	clinical
NC_019008	United Kingdom, Oxford	1999	clinical
NC_019009	United Kingdom	2007	clinical potential
NC_019010	Australia, Melbourne	1949	clinical
NC_019011	Australia, remote Western Australia	1995	clinical potential
NC_019012	Fedderwardersiel, Germany	2011	environmental-marine
NC_019013	Germany	1956	environmental-human
NC_019014	Taiwan	2009	clinical
NC_019015	Fedderwardersiel, Germany	2011	environmental-marine
NC_019016	Fedderwardersiel, Germany	2011	environmental-marine
NC_019017	Fedderwardersiel, Germany	2011	environmental-marine
NC_019018	Israel	2005	veterinary
NC_019019	ND	<2009	ND
NC_019033	Germany,North Rhine-Westphalia	2005	veterinary
NC_019037	Missouri,USA	1992	veterinary
NC_019038	Missouri, USA	1992	veterinary
NC_019039	Missouri, USA	1992	veterinary
NC_019040	Hong Kong	<2010	clinical
NC_019041	Michigan, USA	1982	clinical
NC_019043	Minnesota, USA	2007/8	veterinary
NC_019044	Minnesota, USA	2007/8	veterinary
NC_019045	Canada	<2011	clinical
NC_019046	Netherlands	2008/11	clinical
NC_019047	Nigeria, Ibadan	2008/11	environmental-animal
NC_019049	California, USA	1922	clinical
NC_019050	China	<2009	ND
NC_019051	China	<2009	ND
NC_019052	China	<2009	ND
NC_019053	China	<2009	ND
NC_019054	China	<2009	ND
NC_019056	China	<2009	ND
NC_019057	Hong Kong	2004	clinical
NC_019058	China	<2009	ND
NC_019059	Poland	<2010	environmental-animal

NC_019060	China	<2010	environmental-marine
NC_019061	Minnesota, USA	2007/8	veterinary
NC_019062	Australia	2008	environmental-human
NC_019063	Hong Kong	2009	clinical
NC_019065	Valdívia, Chile	2004	environmental-animal
NC_019066	USA	1995	veterinary
NC_019067	Germany	2001/6	clinical potential
NC_019068	Kosice, Slovakia	<2011	environmental-animal
NC_019069	Vancouver, Canada	2010	clinical
NC_019070	Australia	2008	environmental-human
NC_019073	China	2008	veterinary
NC_019074	South China	2006	environmental-animal
NC_019075	Košice, Slovak Republic	<2011	environmental-animal
NC_019076	Germany	1956	environmental-human
NC_019077	Copenhagen, Denmark	1945	environmental-human
NC_019078	Copenhagen, Denmark	1945	environmental-human
NC_019079	Birmingham, London, UK	1952	clinical
NC_019080	Thailand	<2011	clinical
NC_019081	Mexico	2005/9	clinical
NC_019082	Mexico	2004	clinical
NC_019083	Indiana, USA	1973	clinical
NC_019084	Argentina	2008	clinical
NC_019085	Argentina	2007	clinical
NC_019086	Peru	2005	environmental-human
NC_019087	Germany	2006	clinical
NC_019088	USA	2003	environmental-food
NC_019089	India	2010	clinical
NC_019090	Hong Kong, China	2008	clinical potential
NC_019091	Nigeria	1998/2005	environmental-human
NC_019092	ND	<2012	ND
NC_019093	ND	<2012	ND
NC_019094	Canada	1991	veterinary
NC_019095	China	2008	veterinary
NC_019096	Denmark	2006	clinical potential
NC_019097	Washington, USA	<2012	veterinary
NC_019098	Denmark	2006	veterinary
NC_019099	Taoyuan, Taiwan	2007	clinical
NC_019100	St John's Island, US Virgin Islands	<2004	environmental-marine
NC_019101	Argentina	2006	clinical
NC_019102	China	2006	veterinary
NC_019103	Colombia	2007	clinical potential
NC_019104	USA	2010	environmental-food
NC_019105	USA	<2011	veterinary
NC_019106	USA	<2011	veterinary
NC_019107	USA	<2011	veterinary
NC_019108	USA	<2011	clinical
NC_019109	USA	<2011	clinical
NC_019110	Spain, Extremadura, Llerena	2007	clinical
NC_019111	USA	<2011	clinical
NC_019112	ND	<2011	veterinary
NC_019113	Viet Nam	<2011	clinical potential
NC_019114	Ohio, USA	2001	veterinary
NC_019115	Minnesota, USA	2002	veterinary
NC_019116	Ohio, USA	2002	veterinary
NC_019117	USA	2000	clinical potential
NC_019118	USA	2000	clinical potential
NC_019120	USA	<2011	clinical potential
NC_019121	Ohio, USA	2001	veterinary
NC_019122	Ohio, USA	2002	veterinary
NC_019123	Wisconsin, USA	2008	clinical
NC_019124	Switzerland	2005/9	clinical
NC_019125	ND	<2012	ND
NC_019126	ND	1978	ND
NC_019127	Brazil, Rio Verde, Goias	<2012	clinical potential
NC_019128	USA	<2012	clinical

NC_019129	USA	<2012	clinical
NC_019130	USA	<2012	clinical
NC_019131	Minnesota, USA	2002	veterinary
NC_019132	Wisconsin, USA	2008	clinical
NC_019133	Spain	2008	clinical
NC_019134	Thuringia, Germany	2010	clinical potential
NC_019135	Thuringia, Germany	2010	clinical potential
NC_019136	Thuringia, Germany	2010	clinical potential
NC_019137	Thuringia, Germany	2010	clinical potential
NC_019138	Pennsylvania, USA	1987	clinical potential
NC_019139	Czech Republic	2000/8	clinical
NC_019140	Czech Republic	2000/8	clinical
NC_019141	Portugal	<2010	veterinary
NC_019142	Portugal	<2010	veterinary
NC_019143	Denmark	<2011	veterinary
NC_019144	China	2010	clinical potential
NC_019145	Spain	2009	clinical
NC_019146	Spain	<2012	clinical
NC_019147	Spain	2010	veterinary
NC_019148	Taiwan,Taipei	2000/6	clinical
NC_019149	Portugal	<2011	veterinary
NC_019150	Oregon, USA	<2010	clinical
NC_019151	Spain	2010	clinical
NC_019152	ND	<2010	clinical
NC_019153	Nairobi, Kenya	2009	clinical
NC_019154	Istanbul, Turkey	2001	clinical
NC_019155	Italy	2010	clinical
NC_019156	Jerusalem, Israel	2006	clinical
NC_019157	Italy	2010	clinical
NC_019158	Canada	2010	clinical
NC_019159	Italy	2010	clinical
NC_019160	Sultanate of Oman	2010	clinical
NC_019161	New York, USA	2011	clinical
NC_019162	Hong Kong, China	2010	clinical
NC_019163	Singapore	<2012	clinical
NC_019165	Italy, Veneto region, Padua	2011	clinical
NC_019166	Huizhou, China	2010	clinical
NC_019167	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019168	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019169	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019170	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019171	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019172	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019173	Saga Prefecture, Japan	<2009	environmental-plant and algae
NC_019174	Madrid, Spain	2001	clinical
NC_019175	Majorca Island, Eastern Spain	2001	clinical
NC_019176	Burgos, Northern Spain	2007	clinical
NC_019177	Madrid, Spain	2001	clinical
NC_019178	North America	2003	clinical
NC_019180	Denmark	<2012	clinical
NC_019181	Denmark	<2012	clinical
NC_019182	Australia	<2012	clinical
NC_019183	Spain	2005/7	clinical
NC_019184	Australia	<2012	clinical
NC_019185	Denmark	<2012	clinical
NC_019186	Denmark	<2012	clinical
NC_019187	South Africa	<2009	environmental-animal
NC_019188	USA	1986	environmental-animal
NC_019197	China	2006	clinical
NC_019198	United Kingdom	<2009	environmental-food
NC_019199	Madrid, Spain	<2009	clinical
NC_019200	Spain	2006	environmental-human
NC_019201	China, Hunan, Yongxing	<2009	environmental-animal
NC_019202	Germany	1986	clinical
NC_019203	Spain	2002	environmental-plant and algae

NC_019204	Belgium	2003	ND
NC_019205	Spain	2004	veterinary
NC_019209	Spain	2003	veterinary
NC_019210	ND	1951	environmental-food
NC_019211	Johannesburg, South Africa	<2010	clinical
NC_019213	Michigan, USA	<2010	clinical
NC_019214	China	<2010	veterinary
NC_019215	California,USA	2001	environmental-plant and algae
NC_019217	Germany	2008	environmental-soil
NC_019218	Germany	2008	environmental-soil
NC_019219	ND	<2005	environmental-food
NC_019220	Thailand	<2009	clinical
NC_019221	Lille, France	<1976	environmental-freshwater
NC_019222	Germany	1981	environmental-animal
NC_019223	Austria	2002	environmental-plant and algae
NC_019224	Germany	2003	environmental-plant and algae
NC_019225	USA, Mendocino, CA	1987	clinical potential
NC_019227	ND	<2005	environmental
NC_019228	ND	<2005	environmental
NC_019229	Australia	1997	environmental-animal
NC_019230	Ireland, Gurraig Sound Kilkieran Bay, Galway	<2010	environmental-animal
NC_019231	ND	<2010	environmental-food
NC_019232	ND	<2010	environmental-food
NC_019233	Greece	<2011	environmental-food
NC_019234	USA	1972	clinical
NC_019235	Kyrgyzstan	<2010	clinical
NC_019238	ND	<2010	clinical
NC_019239	ND	<2010	clinical
NC_019240	Mexico	<2012	environmental-food
NC_019241	HongKong, China	2007	environmental-marine
NC_019242	Tokyo, Japan	<2010	ND
NC_019243	Taoyuan County, Taiwan	2005	environmental-plant and algae
NC_019244	Taoyuan County, Taiwan	2005	environmental-plant and algae
NC_019245	Taoyuan County, Taiwan	2005	environmental-plant and algae
NC_019246	Taoyuan County, Taiwan	2005	environmental-plant and algae
NC_019247	Taoyuan County, Taiwan	2005	environmental-plant and algae
NC_019248	Taiwan	<2009	veterinary
NC_019249	Beijing, China	1984	clinical
NC_019250	Beijing, China	1984	clinical
NC_019251	Beijing, China	1984	clinical
NC_019252	USA	2005/9	clinical
NC_019253	Japan	<2010	clinical
NC_019254	Denmark	2012	environmental-wastewaters
NC_019255	Germany,Lower Saxony	2000	veterinary
NC_019256	Denmark	2012	environmental-wastewaters
NC_019257	Australia	<2011	veterinary
NC_019258	Australia	<2011	veterinary
NC_019259	Australia	<2011	veterinary
NC_019260	Tohoku, Japan	2009	veterinary
NC_019261	Taiwan	2005/9	veterinary
NC_019262	South Korea	<2012	veterinary
NC_019263	Sint-Truiden, Belgium	2001	environmental-soil
NC_019264	Waregem, Belgium	2001	environmental-wastewaters
NC_019265	France	<2011	environmental-plant and algae
NC_019266	France	<2011	environmental-plant and algae
NC_019267	Rio de Janeiro, Brazil	1996	clinical
NC_019268	Beijing, China	<2011	clinical
NC_019269	Brno, Czech Republic	<2012	clinical
NC_019270	USA	<2011	environmental-soil
NC_019271	USA	<2012	clinical
NC_019272	Rombo, Northern Tanzania	<2011	clinical
NC_019273	Yeosu, South Korea	2009	environmental-marine
NC_019274	Norwegia	<2012	environmental-animal
NC_019275	Norwegia	2005	environmental-animal
NC_019276	Norwegia	2005	environmental-animal

NC_019277	Norwegia	2005	environmental-animal
NC_019278	Norwegia	2005	environmental-animal
NC_019279	Argentina	2007	clinical
NC_019280	Spain	<2009	clinical
NC_019281	Beijing, China	<2011	clinical
NC_019282	USA	<2012	environmental-soil
NC_019283	Vienna, Austria	1990	environmental-soil
NC_019284	USA	<2010	clinical
NC_019286	Mexico	2005/9	clinical
NC_019287	Yeosu, South Korea	2009	environmental-marine
NC_019288	Yeosu, South Korea	2009	environmental-marine
NC_019289	Korea	2004	environmental-marine
NC_019290	China	2012	environmental-plant and algae
NC_019291	ND	<2005	environmental
NC_019292	France	<2011	environmental-plant and algae
NC_019293	Norwegia	2005	environmental-animal
NC_019294	Norwegia	2005	environmental-animal
NC_019295	Albania	2006	environmental-plant and algae
NC_019296	Belgium	2003	environmental-plant and algae
NC_019297	Spain,Teneriffe	2005	environmental-plant and algae
NC_019298	Spain,Tennerife	2005	environmental-plant and algae
NC_019299	Germany	2008	environmental-soil
NC_019300	United Kingdom	2009	environmental-food
NC_019301	California,USA	2003	environmental-plant and algae
NC_019302	California,USA	2003	environmental-plant and algae
NC_019303	Spain	2010	veterinary
NC_019304	Spain	2011	clinical
NC_019305	Norwegia	2005	environmental-animal
NC_019306	Norwegia	2005	environmental-animal
NC_019307	ND	<2011	environmental-plant and algae
NC_019308	ND	1976	environmental
NC_019309	Japan	1968	environmental-soil
NC_019310	Ifrane, Morocco	2009	environmental-plant and algae
NC_019311	Sydney, Australia	2002/7	clinical
NC_019312	Germany	2009	environmental-wastewaters
NC_019313	Nepal	<2012	environmental-plant and algae
NC_019314	Poland	2008	environmental-freshwater
NC_019315	Korea	2004	environmental-marine
NC_019316	Yeosu, South Korea	2009	environmental-marine
NC_019317	China, Tibet	<2012	environmental-soil
NC_019318	USA	2012	environmental-soil
NC_019319	Poland	2008	environmental-freshwater
NC_019320	Republic of Korea	2012	environmental-soil
NC_019321	Malasia	<2012	environmental-plant and algae
NC_019322	China	2009/10	clinical
NC_019323	China	2009/10	clinical
NC_019325	China	<2012	ND
NC_019326	USA, Indiana	<2012	environmental-soil
NC_019327	ND	<2012	ND
NC_019328	USA, Georgia	1980	environmental-plant and algae
NC_019329	ND	<2012	ND
NC_019330	USA, Indiana	<2012	environmental-soil
NC_019331	USA, Indiana	<2012	environmental-soil
NC_019332	USA, Indiana	<2012	environmental-soil
NC_019333	New Zealand	1972	environmental-plant and algae
NC_019334	USA, California	1982	environmental-plant and algae
NC_019335	USA	<2012	veterinary
NC_019336	USA	<2012	veterinary
NC_019337	ND	<2012	environmental-food
NC_019338	USA, Indiania	<2012	environmental-soil
NC_019339	USA, Indiana	<2012	environmental-soil
NC_019340	Weihenstephan, Germany	<2013	environmental-food
NC_019341	Yugoslavia	1953	environmental-plant and algae
NC_019342	USA	<2012	veterinary
NC_019343	USA	<2012	veterinary

NC_019344	ND	<2012	ND
NC_019345	Australia	2008	clinical
NC_019346	Nebraska, USA	<2012	clinical
NC_019347	France	<2012	environmental-food
NC_019348	France	<2012	environmental-food
NC_019349	France	<2012	environmental-food
NC_019350	France	<2012	environmental-food
NC_019351	France	<2012	environmental-food
NC_019353	South Korea	<2011	environmental-food
NC_019354	Japan,Ishikawa	2008	environmental-food
NC_019355	Japan,Ishikawa	2008	environmental-food
NC_019356	Poland	2008	environmental-freshwater
NC_019357	ND	<1982	ND
NC_019358	England, London	1950	veterinary
NC_019359	Lithuania	2010	clinical
NC_019360	India	2010	clinical
NC_019361	China	<2011	veterinary
NC_019362	Antarctica, Vestfold Hills	<2011	environmental-freshwater
NC_019363	Antarctica, Vestfold Hills	<2011	environmental-freshwater
NC_019364	Antarctica, Vestfold Hills	<2011	environmental-freshwater
NC_019365	London, UK	<2012	environmental-human
NC_019366	Yeosu, South Korea	2009	environmental-marine
NC_019367	"Jerusalem, Israel"	1998	environmental
NC_019368	Sydney, Australia	2004	clinical
NC_019369	Japan	<2012	environmental-soil
NC_019370	Italy	<2012	clinical
NC_019371	China	<2013	environmental-food
NC_019372	China	<2013	environmental-food
NC_019373	china	<2012	veterinary
NC_019374	china	<2012	veterinary
NC_019375	Greece	2012	clinical
NC_019376	Philippines	1973	environmental-freshwater
NC_019377	ND	<1991	environmental-food
NC_019378	United Kingdom	<2012	environmental-soil
NC_019379	China	<2013	environmental-food
NC_019380	Thailand	<2012	veterinary
NC_019381	Mexico	<1977	ND
NC_019384	France	2009	clinical
NC_019385	Xinjiang Uyghur, China	2013	environmental-food
NC_019387	USA	2011	environmental-freshwater
NC_019388	USA	2011	environmental-freshwater
NC_019389	Czech Republic	<2012	clinical
NC_019390	Czech Republic	<2012	clinical
NC_019392	Saxony-Anhalt, Germany	<2013	veterinary
NC_019394	Bangladesh	<2012	environmental-marine
NC_019397	China	<2013	environmental
NC_019424	Hong Kong, China	1996/2008	clinical
NC_019426	Poland, Zelazny Most	<2013	environmental-wastewaters
NC_019428	Finland, Lake Vesijarvi	1986	environmental-freshwater
NC_019429	Finland, Lake Vesijarvi	1986	environmental-freshwater
NC_019430	Ireland	<2013	environmental-food
NC_019431	Ireland	<2013	environmental-food
NC_019432	Ireland	<2013	environmental-food
NC_019433	Ireland	<2013	environmental-food
NC_019434	Ireland	<2013	environmental-food
NC_019436	Ireland	<2013	environmental-food
NC_019437	Ireland	<2013	environmental-food
NC_019438	Ireland	<2013	environmental-food
NC_019440	Finland, Lake Vesijarvi	1986	environmental-freshwater
NC_019533	Shaanxi province, China	<2012	environmental-plant and algae
NC_019534	Japan	1987/94	clinical
NC_019535	Shaanxi province, China	<2012	environmental-plant and algae
NC_019536	Shaanxi province, China	<2012	environmental-plant and algae
NC_019553	France	2008/9	environmental-food
NC_019554	France	2008/9	environmental-food

NC_019555	Oregon, USA	1997	environmental-plant and algae
NC_019557	ND	<2012	ND
NC_019558	ND	<2012	ND
NC_019561	Canada, Aklavik village, Northwest Territories	<2012	clinical
NC_019562	Canada, Aklavik village, Northwest Territories	<2012	clinical
NC_019564	Canada, Aklavik village, Northwest Territories	<2012	clinical
NC_019565	Canada, Aklavik village, Northwest Territories	<2012	clinical
NC_019669	China	<2012	environmental-food
NC_019677	Sri Lanka	1973	environmental-freshwater
NC_019679	USA	1968	environmental-marine
NC_019681	California, USA	1963	environmental-freshwater
NC_019685	Sri Lanka	1973	environmental-freshwater
NC_019686	USA	1968	environmental-marine
NC_019687	Canada	<2012	veterinary
NC_019688	Canada	<2012	veterinary
NC_019690	ND	<2012	ND
NC_019691	Switzerland	1972	environmental-freshwater
NC_019692	Switzerland	1972	environmental-freshwater
NC_019694	USA	<2012	environmental-soil
NC_019696	Germany	1962	environmental-soil
NC_019698	USA	<2012	environmental-freshwater
NC_019699	Germany	1962	environmental-soil
NC_019700	USA	<2012	environmental-soil
NC_019727	USA	1949	environmental-freshwater
NC_019728	USA	1949	environmental-freshwater
NC_019730	USA	1970	environmental-soil
NC_019731	USA	1970	environmental-soil
NC_019732	USA	1970	environmental-soil
NC_019733	ND	<2012	ND
NC_019734	ND	<2012	ND
NC_019735	ND	<2012	ND
NC_019736	ND	<2012	ND
NC_019737	ND	<2012	ND
NC_019739	San Francisco, USA	1971	environmental-soil
NC_019740	San Francisco, USA	1971	environmental-soil
NC_019741	San Francisco, USA	1971	environmental-soil
NC_019742	San Francisco, USA	1971	environmental-soil
NC_019743	San Francisco, USA	1971	environmental-soil
NC_019744	Stockholm, Sweden	1972	environmental-soil
NC_019746	ND	<2012	environmental-freshwater
NC_019747	ND	<2012	environmental-freshwater
NC_019749	Havana, Cuba	<2012	environmental-freshwater
NC_019750	Havana, Cuba	<2012	environmental-freshwater
NC_019752	USA	1949	environmental-freshwater
NC_019754	ND	<2012	ND
NC_019755	ND	<2012	ND
NC_019756	ND	<2012	ND
NC_019758	Stockholm, Sweden	1972	environmental-soil
NC_019759	ND	<2012	environmental-freshwater
NC_019760	San Francisco, USA	1971	environmental-soil
NC_019761	San Francisco, USA	1971	environmental-soil
NC_019762	San Francisco, USA	1971	environmental-soil
NC_019763	USA	1970	environmental-soil
NC_019764	USA	1970	environmental-soil
NC_019765	Cuba	<2012	environmental-freshwater
NC_019766	Cuba	<2012	environmental-freshwater
NC_019772	Cambridge, UK	1939	environmental-freshwater
NC_019773	Cambridge, UK	1939	environmental-freshwater
NC_019774	Cambridge, UK	1939	environmental-freshwater
NC_019775	Cambridge, UK	1939	environmental-freshwater
NC_019777	ND	<2012	environmental-freshwater
NC_019783	Saskatchewan, Canada	<2012	environmental-wastewaters
NC_019784	Lyon, France	2006/7	veterinary
NC_019785	Lyon, France	2006/7	veterinary
NC_019786	Lyon, France	2006/7	veterinary

NC_019787	Lyon, France	2006/7	veterinary
NC_019788	Lyon, France	2006/7	veterinary
NC_019789	Chile	2007	environmental-soil
NC_019790	Chile	2007	environmental-soil
NC_019794	Lyon, France	2006/7	veterinary
NC_019795	Lyon, France	2006/7	veterinary
NC_019796	Lyon, France	2006/7	veterinary
NC_019797	Lyon, France	2006/7	veterinary
NC_019798	Canada	<2012	environmental-wastewaters
NC_019846	Granada, Spain	<2012	environmental-plant and algae
NC_019847	Granada, Spain	<2012	environmental-plant and algae
NC_019848	Granada, Spain	<2012	environmental-plant and algae
NC_019849	Granada, Spain	<2012	environmental-plant and algae
NC_019888	New Jersey, USA	2005	clinical
NC_019889	Oman	<2012	clinical
NC_019893	Russia	2008	environmental-plant and algae
NC_019894	Russia	2008	environmental-plant and algae
NC_019895	Russia	2008	environmental-plant and algae
NC_019898	Tokyo, Japan	2007	environmental-wastewaters
NC_019899	New Jersey, USA	2005	clinical
NC_019900	Kenya	<2012	environmental-food
NC_019906	Besançon, France	<2013	clinical
NC_019937	ND	<2011	environmental-soil
NC_019938	ND	<2011	environmental-soil
NC_019939	ND	<2011	environmental-soil
NC_019941	Massachusetts, USA	<2011	environmental-estuarine
NC_019953	France	<2012	environmental-marine
NC_019956	USA	<2012	environmental
NC_019957	USA	<2011	clinical
NC_019958	USA	<2011	clinical
NC_019959	USA	<2011	clinical
NC_019961	Helsinki, Finland	1986	clinical
NC_019969	Helsinki, Finland	1986	clinical
NC_019979	ND	<2011	ND
NC_019980	ND	<2011	ND
NC_019981	ND	<2011	ND
NC_019982	ND	<2011	ND
NC_019983	Vancouver, Canada	2007	environmental-wastewaters
NC_019984	Vancouver, Canada	2007	environmental-wastewaters
NC_019985	China	<2013	clinical
NC_019986	Lucknow, India	2010/11	clinical
NC_019987	Lucknow, India	2010/11	clinical
NC_019988	Lucknow, India	2010/11	clinical
NC_019989	Lucknow, India	2010/11	clinical
NC_019990	Lucknow, India	2010/11	clinical
NC_019991	Vancouver, Canada	2007	environmental-wastewaters
NC_019992	Denmark	<2011	environmental-animal
NC_020050	Stockholm, Sweden	1972	environmental-soil
NC_020051	ND	<2012	environmental-freshwater
NC_020052	Cuba	<2012	environmental-freshwater
NC_020053	USA	<2012	environmental-freshwater
NC_020056	Cambridge, UK	1939	environmental-freshwater
NC_020057	ND	<2012	environmental
NC_020060	Colombia	<2012	environmental-plant and algae
NC_020061	Colombia	<2012	environmental-plant and algae
NC_020062	Colombia	<2012	environmental-plant and algae
NC_020086	Viet Nam	2004	clinical
NC_020087	Ho Chi Minh City, Viet Nam	2006	clinical potential
NC_020088	Viet Nam	2004	clinical
NC_020091	Germany	2002	clinical potential
NC_020121	USA, Riverside, CA	<2012	environmental-plant and algae
NC_020122	France	<2012	clinical
NC_020123	France	<2012	clinical
NC_020124	China, Jianghan Plain, Hubei	<2011	environmental-soil
NC_020128	Minnesota, USA	2013	veterinary

NC_020129	Minnesota, USA	2013	veterinary
NC_020130	Minnesota, USA	2013	veterinary
NC_020131	France	<2012	clinical
NC_020132	New York, USA	2010	clinical
NC_020157	Cambridge, UK	1939	environmental-freshwater
NC_020165	Alberta, Canada	<2012	clinical potential
NC_020180	France	<2012	clinical
NC_020182	France	<2012	clinical
NC_020183	Spain	2011	environmental-human
NC_020196	València, Spain	<2011	environmental-animal
NC_020208	USA	1927	environmental-food
NC_020212	Taiwan	2013	environmental
NC_020227	Japan	<2012	veterinary
NC_020228	Madrid, Spain	2004/10	clinical
NC_020237	Denmark	<2012	veterinary
NC_020239	USA	1978	environmental
NC_020240	USA	1978	environmental
NC_020241	USA	1978	environmental
NC_020242	USA	1978	environmental
NC_020243	USA	1978	environmental
NC_020249	USA	1978	environmental
NC_020250	USA	1978	environmental
NC_020251	Vietnam	1980	clinical
NC_020261	Dublin, Ireland	<2013	clinical potential
NC_020262	Dublin, Ireland	<2013	clinical potential
NC_020263	Dublin, Ireland	<2013	clinical potential
NC_020264	Alberta, Canada	<2012	clinical potential
NC_020265	Alberta, Canada	<2012	clinical potential
NC_020266	Alberta, Canada	<2012	clinical potential
NC_020267	Alberta, Canada	<2012	clinical potential
NC_020268	Alberta, Canada	<2012	clinical potential
NC_020269	Alberta, Canada	<2012	clinical potential
NC_020270	China	2010	environmental-animal
NC_020271	Sydney, Australia	2006	clinical
NC_020273	ND	<2011	environmental
NC_020274	Alberta, Canada	<2012	clinical potential
NC_020275	South Korea	<2012	clinical
NC_020276	South Korea	<2012	clinical
NC_020277	Spain	1990	veterinary
NC_020278	Guangzhou, China	2008	veterinary
NC_020279	Vietnam	2011	veterinary
NC_020280	Vietnam	2011	veterinary
NC_020281	Vietnam	2011	veterinary
NC_020282	Vietnam	2008	veterinary
NC_020287	California, USA	<2012	environmental-freshwater
NC_020288	California, USA	<2012	environmental-freshwater
NC_020289	California, USA	<2012	environmental-freshwater
NC_020290	California, USA	<2012	environmental-freshwater
NC_020292	Japan	1959	environmental-soil
NC_020293	ND	<2012	ND
NC_020295	Vietnam	2011	veterinary
NC_020296	California, USA	<2012	environmental-freshwater
NC_020297	California, USA	<2012	environmental-freshwater
NC_020298	California, USA	<2012	environmental-freshwater
NC_020303	China	<2012	environmental-soil
NC_020305	France	<2012	environmental-marine
NC_020306	USA	2012	clinical
NC_020308	USA	2012	clinical
NC_020377	Poland	2005	environmental-soil
NC_020378	Poland	2005	environmental-soil
NC_020379	Poland	2005	environmental-soil
NC_020380	Poland	2005	environmental-soil
NC_020381	Poland	2005	environmental-soil
NC_020382	Poland	2005	environmental-soil
NC_020383	Poland	2005	environmental-soil

NC_020384	Poland	2005	environmental-soil
NC_020385	Poland	2005	environmental-soil
NC_020390	Poland	2005	environmental-soil
NC_020391	Poland	2005	environmental-soil
NC_020392	Poland	2005	environmental-soil
NC_020393	Poland	2005	environmental-soil
NC_020394	Poland	2005	environmental-soil
NC_020412	Ho Chi Minh, Vietnam	2009/10	clinical
NC_020413	Ho Chi Minh, Vietnam	2009/10	clinical
NC_020420	Saitama, Japan	<2007	environmental-animal
NC_020421	Saitama, Japan	<2007	environmental-animal
NC_020422	Saitama, Japan	<2007	environmental-animal
NC_020451	Zanzibar Tanzania	1999	veterinary
NC_020452	France	1996	clinical
NC_020513	USA	<2012	clinical
NC_020522	Shanghai, China	2011	clinical potential
NC_020523	ND	1963	environmental
NC_020524	China	<2013	clinical
NC_020525	Australia	2009	clinical
NC_020527	France	<2013	environmental-plant and algae
NC_020530	Switzerland	2001/8	clinical
NC_020531	Switzerland	2001/8	clinical
NC_020534	Switzerland	2001/8	clinical
NC_020535	Switzerland	2001/8	clinical
NC_020538	Switzerland	2001/8	clinical
NC_020539	Switzerland	2001/8	clinical
NC_020542	India	2010	environmental-soil
NC_020543	India	2010	environmental-soil
NC_020544	India	2010	environmental-soil
NC_020545	Mindanao, Philippines	<2012	environmental-soil
NC_020548	Japan	<2011	environmental-soil
NC_020550	Kilimanjaro, Tanzania	2001	clinical
NC_020551	USA	1990	clinical
NC_020552	China	<2012	clinical
NC_020553	ND	1963	environmental
NC_020554	Selangor, Malaysia	<2012	environmental-plant and algae
NC_020556	Okinawa, Japan	2006	clinical
NC_020560	France	<2013	environmental-plant and algae
NC_020562	India	2010	environmental-soil
NC_020563	India	2010	environmental-soil
NC_020565	Switzerland	2001/8	clinical
NC_020567	Switzerland	2001/8	clinical
NC_020797	India	<2013	environmental-plant and algae
NC_020798	India	<2013	environmental-plant and algae
NC_020801	India	<2013	environmental-plant and algae
NC_020811	China, Beijing	2012	clinical
NC_020816	Florida, USA	2004	environmental-plant and algae
NC_020817	Florida, USA	2004	environmental-plant and algae
NC_020818	China	<2013	veterinary
NC_020820	Japan	1993	environmental-food
NC_020821	Japan	1993	environmental-food
NC_020822	Japan	1993	environmental-food
NC_020823	Japan	1993	environmental-food
NC_020824	Japan	1993	environmental-food
NC_020825	Japan	1993	environmental-food
NC_020826	Japan	1993	environmental-food
NC_020827	Japan	1993	environmental-food
NC_020828	Japan	1993	environmental-food
NC_020884	South Korea	<2013	environmental-soil
NC_020885	ND	<2012	ND
NC_020886	ND	<2012	ND
NC_020893	Taiwan	2012	clinical
NC_020894	ND	<2012	ND
NC_020907	Antarctica, McMurdo Sound	<2013	environmental-freshwater
NC_020909	USA, Deadhorse, Alaska	<2013	environmental-freshwater

NC_020910	USA, Deadhorse, Alaska	<2013	environmental-freshwater
NC_020914	Ontario, Canada	<2012	environmental-plant and algae
NC_020915	Ireland	1986	environmental-plant and algae
NC_020916	Ravenna, Italy	1991	environmental-plant and algae
NC_020918	UK	1959	environmental-plant and algae
NC_020919	Germany	1979	environmental-plant and algae
NC_020920	Ireland	1986	environmental-plant and algae
NC_020921	Massachusetts, USA	2003	environmental-plant and algae
NC_020946	Kahe Mpya, Rombo district, Tanzania	2000	clinical
NC_020947	California, USA	1959	clinical
NC_020948	Netherlands	2005	clinical
NC_020949	Netherlands	2004	clinical
NC_020950	Netherlands	2004	clinical
NC_020951	Ciskei, South Africa	<1994	clinical
NC_020952	Transkei, South Africa	<1994	clinical
NC_020953	Vancouver, Canada	2004	clinical
NC_020955	Paris, France	2006	clinical
NC_020956	London, UK	<2011	clinical
NC_020957	California, USA	1967	clinical
NC_020958	Southampton, UK	2009	clinical
NC_020959	Southampton, UK	2009	clinical
NC_020960	Southampton, UK	2009	clinical
NC_020961	Southampton, UK	2009	clinical
NC_020962	Southampton, UK	2009	clinical
NC_020963	Southampton, UK	2009	clinical
NC_020979	Kahe Mpya, Rombo district, Tanzania	2000	clinical
NC_020980	Netherlands	2004	clinical
NC_020981	Netherlands	2005	clinical
NC_020983	Bordeaux, France	2004	clinical
NC_020984	Sweden	2007	clinical
NC_020985	Tourcoing, France	2008	clinical
NC_020986	Southampton, UK	2009	clinical
NC_020987	Southampton, UK	2009	clinical
NC_020988	Southampton, UK	2009	clinical
NC_020989	Southampton, UK	2009	clinical
NC_020991	Vietnam	2009/10	clinical
NC_020994	Brazil	2004/8	clinical
NC_021049	California, USA	1968	clinical
NC_021051	California, USA	1968	clinical
NC_021056	Antarctic	<2012	environmental-plant and algae
NC_021060	Copenhagen, Denmark	2003	clinical
NC_021076	USA	2007	clinical
NC_021077	China	<2013	environmental-soil
NC_021078	Sydney, Australia	2010	clinical
NC_021079	Sydney, Australia	2010	clinical
NC_021080	ND	<1988	environmental-plant and algae
NC_021086	California, USA	<2012	clinical potential
NC_021087	Germany	2010	clinical
NC_021155	UK	<2014	veterinary
NC_021156	UK	<2014	veterinary
NC_021157	UK	<2014	veterinary
NC_021158	Russia,Kolyma Lowland	<2009	environmental-soil
NC_021159	Egypt	2014	environmental-freshwater
NC_021170	Canada	2010	clinical
NC_021180	Japan, Saitama	2010	clinical
NC_021183	ND	<2012	environmental-soil
NC_021185	China	2010/11	veterinary
NC_021186	China	<2012	veterinary
NC_021187	China, Jixi County, Guangxi Zhuang Autonomous	<2013	environmental-freshwater
NC_021188	China, Jixi County, Guangxi Zhuang Autonomous	<2013	environmental-freshwater
NC_021198	Taiwan	<2011	clinical
NC_021199	Taiwan	<2011	clinical
NC_021209	Poland	2008	environmental-soil
NC_021210	Antarctica	<2013	environmental-freshwater
NC_021211	Antarctica	<2013	environmental-freshwater

NC_021212	Antarctica	<2013	environmental-freshwater
NC_021225	China	<2014	environmental-food
NC_021226	China	<2014	environmental-food
NC_021227	China	<2014	environmental-food
NC_021228	China	<2014	environmental-food
NC_021229	ND	1992	environmental-soil
NC_021230	Ohio, USA	<2013	clinical
NC_021231	Bobigny, France	2004	clinical
NC_021233	China	<2014	environmental-food
NC_021234	China	<2014	environmental-food
NC_021238	Greece	<2012	clinical
NC_021239	Jerusalem, Israel	1998	environmental
NC_021240	Jerusalem, Israel	1998	environmental
NC_021241	Jerusalem, Israel	1998	environmental
NC_021250	Denmark	<2013	environmental-marine
NC_021277	ND	<2012	environmental-human
NC_021278	Seoul, Republic of Korea	<2013	clinical
NC_021279	Seoul, Republic of Korea	<2013	clinical
NC_021286	China	2014	environmental-human
NC_021287	China	2014	environmental-human
NC_021288	China	2014	environmental-human
NC_021289	USA	<2013	environmental
NC_021289	Japan	<2013	environmental-animal
NC_021290	USA	<2013	environmental
NC_021291	USA	<2013	environmental
NC_021292	Hong Kong	2010	clinical potential
NC_021292	ND	<2013	environmental
NC_021293	Tennessee, USA	1978	clinical
NC_021293	Switzerland	2008	clinical
NC_021294	Italy, Arenzano	<2013	environmental
NC_021295	Japan	<2013	environmental-animal
NC_021295	Red Sea, Israel	2009	environmental-animal
NC_021296	USA	<2013	environmental-food
NC_021297	USA	2002	environmental-food
NC_021298	ND	<2013	environmental
NC_021299	India	2014	clinical
NC_021300	India	2014	clinical
NC_021301	Okayama, Japan	1999	environmental-soil
NC_021302	Virginia, USA	1981	environmental-human
NC_021303	ND	<2009	ND
NC_021304	ND	<2011	ND
NC_021305	United Kingdom	<2013	ND
NC_021306	Antarctica	2013	environmental-soil
NC_021307	South America	2007	environmental-soil
NC_021308	Jiangsu, China	2011	environmental-plant and algae
NC_021309	USA	2008	veterinary
NC_021310	USA	2001	veterinary
NC_021311	USA	2005	veterinary
NC_021312	Siberia, Russia	2013	environmental-soil
NC_021313	Siberia, Russia	2013	environmental-soil
NC_021314	Siberia, Russia	2013	environmental-soil
NC_021315	Siberia, Russia	2013	environmental-soil
NC_021316	Siberia, Russia	2013	environmental-soil
NC_021317	ND	1955	clinical
NC_021318	Germany	<2011	clinical
NC_021319	Germany	<2011	clinical
NC_021320	Germany	<2011	clinical
NC_021321	Recife, Brazil	1970	environmental-food
NC_021322	Recife, Brazil	1970	environmental-food
NC_021323	Recife, Brazil	1970	environmental-food
NC_021324	Recife, Brazil	1970	environmental-food
NC_021325	Recife, Brazil	1970	environmental-food
NC_021328	Huazhong, China	2006	environmental
NC_021329	Czech Republic	2002	environmental
NC_021330	Czech Republic	2002	environmental

NC_021331	Czech Republic	2002	environmental
NC_021332	Australia	2011	clinical
NC_021333	Hangzhou 310021, P. R. China	2014	environmental-soil
NC_021334	Denmark	1996	veterinary
NC_021335	Denmark	1996	veterinary
NC_021336	ND	<1965	ND
NC_021337	Poland	2015	environmental-food
NC_021338	ND	<2013	ND
NC_021339	ND	<1979	ND
NC_021340	France	2013	clinical
NC_021341	Netherlands	<2014	veterinary
NC_021342	Netherlands	<2014	clinical
NC_021343	Netherlands	<2014	clinical
NC_021344	Netherlands	<2014	veterinary
NC_021345	Netherlands	<2014	veterinary
NC_021346	Netherlands	<2014	clinical
NC_021347	ND	<2014	environmental-food
NC_021348	ND	<2014	environmental-food
NC_021349	ND	<2014	environmental-food
NC_021350	ND	<1997	ND
NC_021351	Denmark	<2001	environmental-food
NC_021353	Osaka, Japan	1981	environmental-freshwater
NC_021354	ND	<1997	ND
NC_021355	ND	1984	veterinary
NC_021356	ND	<1987	ND
NC_021357	ND	1978	veterinary
NC_021358	Salamanca, Spain	1995	environmental-soil
NC_021359	Beijing, China	<2013	clinical
NC_021361	USA, California	<2013	environmental-plant and algae
NC_021361	Złoty Stok, Poland	2008	environmental-soil
NC_021362	United Kingdom	1951	clinical
NC_021363	Japan	<1986	veterinary
NC_021364	Taiwan	2010	clinical
NC_021365	Taiwan	2010	clinical
NC_021366	Taiwan	2010	clinical
NC_021367	Taiwan	2010	clinical
NC_021368	Taiwan	2010	clinical
NC_021369	Taiwan	2010	clinical
NC_021370	Taiwan	2010	clinical
NC_021371	Bering sea	2013	environmental-marine
NC_021372	ND	1992	environmental-food
NC_021373	Germany	1993	environmental
NC_021374	ND	<1974	ND
NC_021375	South Korea	2004	environmental-food
NC_021376	ND	<1998	ND
NC_021377	ND	<1993	ND
NC_021378	ND	<1983	environmental-food
NC_021379	London, UK	1972	clinical
NC_021488	France	<2013	clinical
NC_021489	Japan	<2013	clinical
NC_021492	Singapore	<2013	environmental-plant and algae
NC_021493	USA	<2013	environmental-animal
NC_021495	Beijing, China	2004	environmental-animal
NC_021496	Beijing, China	2004	environmental-animal
NC_021497	Beijing, China	2004	environmental-animal
NC_021498	Beijing, China	2004	environmental-animal
NC_021501	Taiwan	2010	clinical
NC_021502	France	2010	clinical
NC_021503	Beijing, China	2004	environmental-animal
NC_021504	Beijing, China	2004	environmental-animal
NC_021506	Tokyo, Japan	1993	environmental-wastewaters
NC_021511	China	2010	veterinary
NC_021512	China	2010	clinical
NC_021513	Switzerland	2011	clinical potential
NC_021515	Cork, Ireland	<2013	environmental-food

NC_021516	Cork, Ireland	<2013	environmental-food
NC_021517	Cork, Ireland	<2013	environmental-food
NC_021518	Cork, Ireland	<2013	environmental-food
NC_021519	Cork, Ireland	<2013	environmental-food
NC_021520	Cork, Ireland	<2013	environmental-food
NC_021522	China	2010	clinical potential
NC_021523	China	2010	environmental-animal
NC_021524	China	2010	clinical
NC_021525	Cork, Ireland	<2013	environmental-food
NC_021526	Cork, Ireland	<2013	environmental-food
NC_021527	Cork, Ireland	<2013	environmental-food
NC_021528	Cork, Ireland	<2013	environmental-food
NC_021552	California, USA	2005	clinical
NC_021570	China	2010	veterinary
NC_021575	Mississippi, USA	1964	environmental-freshwater
NC_021576	Greece	2009	clinical
NC_021594	Germany, Biestow	<2009	environmental-plant and algae
NC_021622	Oslo, Norway	2007	clinical
NC_021623	Washington, USA	<2013	clinical
NC_021624	Texas, USA	<2013	clinical
NC_021654	Rome, Italy	2011	clinical
NC_021655	Rome, Italy	2011	clinical
NC_021656	Rome, Italy	2011	clinical
NC_021657	Brazil, Rio de Janeiro	1993	clinical
NC_021660	São Paulo, Brazil	2009	clinical
NC_021662	King George Island, Antarctica	2008	environmental-marine
NC_021664	São Paulo, Brazil	2005	clinical
NC_021666	Rome, Italy	2011	clinical
NC_021667	Rome, Italy	2011	clinical
NC_021668	King George Island, Antarctica	2008	environmental-marine
NC_021669	King George Island, Antarctica	2008	environmental-marine
NC_021718	Crete, Greece	2001	environmental-marine
NC_021722	Warsaw, Poland	<2013	environmental-human
NC_021724	California, USA	<2013	clinical
NC_021727	Beijing, China	2007	clinical
NC_021728	Beijing, China	2007	clinical
NC_021730	Beijing, China	2008	clinical
NC_021731	Beijing, China	2008	clinical
NC_021732	Beijing, China	2008	clinical
NC_021734	Beijing, China	2007	clinical
NC_021737	Switzerland	2004	veterinary
NC_021742	Cork, Ireland	<2013	clinical potential
NC_021745	Guizhou, China	1997	environmental-plant and algae
NC_021808	France	1998	veterinary
NC_021811	USA, Ohio	2011	clinical
NC_021813	USA, Washington	<2013	clinical potential
NC_021815	New York, USA	2011	clinical potential
NC_021816	New York, USA	2011	clinical potential
NC_021817	India	2003	clinical potential
NC_021819	USA, Arizona	2012	clinical potential
NC_021828	USA	1994	clinical potential
NC_021832	Taiwan	<2013	clinical potential
NC_021835	China, Wuhan Province	<2013	veterinary
NC_021836	China, Wuhan Province	<2013	veterinary
NC_021841	USA, Ohio	2011	clinical
NC_021842	USA, Washington	<2013	clinical potential
NC_021843	New York, USA	2011	clinical potential
NC_021845	USA, Arizona	2012	clinical potential
NC_021869	USA, Ohio	2011	clinical
NC_021875	Japan,Chiba, Kashiha	<2014	environmental-human
NC_021876	Japan,Chiba, Kashiha	<2014	environmental-human
NC_021886	Japan	<2013	environmental-animal
NC_021903	Hangzhou, China	<2013	environmental-human
NC_021904	Hangzhou, China	<2013	environmental-human
NC_021906	Mexico, Huautla	<2013	environmental-plant and algae

NC_021907	Mexico, Huautla	<2013	environmental-plant and algae
NC_021908	Mexico, Huautla	<2013	environmental-plant and algae
NC_021909	Mexico, Huautla	<2013	environmental-plant and algae
NC_021910	Mexico, Huautla	<2013	environmental-plant and algae
NC_021911	Mexico, Huautla	<2013	environmental-plant and algae
NC_021912	Hangzhou, China	<2013	environmental-human
NC_021922	Henan, China	2006	clinical
NC_021927	Russia	<2013	clinical
NC_021976	Ghana	2007	environmental-food
NC_021977	Ghana	2007	environmental-food
NC_021978	Ghana	2007	environmental-food
NC_021979	Ghana	2007	environmental-food
NC_021980	Israel	2005	clinical
NC_021981	Israel	2005	clinical
NC_021982	Israel	2005	clinical
NC_021983	Israel	2005	clinical
NC_021986	Kouroussa, Guinea	<2012	environmental-freshwater
NC_021987	Australia	2009	clinical
NC_021988	Australia	2009	clinical
NC_021989	Australia	2009	clinical
NC_021990	Australia	2009	clinical
NC_021992	Ghana	2007	environmental-food
NC_021993	Ghana	2007	environmental-food
NC_021995	Australia	2009	clinical
NC_021996	Australia	2009	clinical
NC_021997	Israel	2005	clinical
NC_021998	Israel	2005	clinical
NC_021999	Israel	2005	clinical
NC_022001	Kouroussa, Guinea	<2012	environmental-freshwater
NC_022042	Japan	1990	environmental-soil
NC_022043	Japan	1990	environmental-soil
NC_022044	Japan	1990	environmental-soil
NC_022046	USA	2002	clinical
NC_022049	Japan	1990	environmental-soil
NC_022050	Japan	1990	environmental-soil
NC_022051	USA	2002	clinical potential
NC_022078	ZheJiang, China	2010	clinical
NC_022083	ZheJiang, China	2010	clinical
NC_022105	Addlestone, United Kingdom	2008	environmental-animal
NC_022114	Go¨teborg, Sweden	1998	environmental-human
NC_022123	Go¨teborg, Sweden	1998	environmental-human
NC_022125	Prague, Czech Republic	<2012	environmental-soil
NC_022225	China, Shandong	<2013	veterinary
NC_022227	Seoul, South Korea	2010	clinical
NC_022228	Seoul, South Korea	2010	clinical
NC_022235	Denmark	<2013	environmental-freshwater
NC_022242	Italy,Veneto, Verona	1998	clinical
NC_022243	Oxford, United Kingdom	2005	clinical
NC_022267	United Kingdom	1997	veterinary
NC_022271	USA	1993	environmental-marine
NC_022333	Kolkata, India	2009	clinical
NC_022344	Guangzhou, China	2000	clinical
NC_022345	Colombia	<2013	clinical
NC_022346	Colombia	<2013	clinical
NC_022348	California, USA	2011	clinical potential
NC_022354	Canada	2000	clinical
NC_022355	California, USA	2011	clinical potential
NC_022358	Sapporo, Japan	2010	environmental-freshwater
NC_022371	Brussels, Belgium	<2013	clinical
NC_022372	Japan, Hokkaido	2002/5	veterinary
NC_022374	Hong Kong, China	2007	clinical
NC_022375	China	<2013	clinical
NC_022376	Uruguay	2006	clinical potential
NC_022377	China	<2013	veterinary
NC_022436	France, Etang de Berre	<2013	environmental-marine

NC_022520	New Jersey, USA	2005	clinical
NC_022522	Poland	2009	veterinary
NC_022533	Tsukuba, Japan	2011	environmental-animal
NC_022534	Tsukuba, Japan	2011	environmental-animal
NC_022536	Philippines	2000	environmental-plant and algae
NC_022539	France	1998	environmental-plant and algae
NC_022540	France	1998	environmental-plant and algae
NC_022542	France	1998	environmental-plant and algae
NC_022551	USA	<2013	environmental-animal
NC_022565	Bogotá, Colombia	<2012	clinical
NC_022570	Scotland	1968	clinical potential
NC_022585	Vietnam	<2013	clinical
NC_022587	China, Sinkiang	2007	environmental-food
NC_022589	Canada	2010	clinical
NC_022590	Argentina	2009	environmental-animal
NC_022598	Japan	2002	clinical
NC_022599	Argentina	<2013	environmental-freshwater
NC_022605	Taiwan	2010	clinical
NC_022609	Canada	2011	clinical
NC_022610	Taiwan	2010	clinical
NC_022618	Germany,Lower Saxony	2012	veterinary
NC_022649	USA	2007	clinical
NC_022650	USA	2007	clinical
NC_022651	USA	2007	clinical
NC_022652	Hong Kong, China	2010	clinical
NC_022656	Norwich, United Kingdom	2001	clinical
NC_022661	USA	2007	clinical
NC_022662	USA	2007	clinical
NC_022739	Stuttgart, Germany	<2012	environmental-soil
NC_022740	India	<2013	clinical
NC_022778	Marseille, France	2011	clinical
NC_022782	Japan, IZU, SHIZUOKA PREFECTURE	1966	environmental-soil
NC_022783	Japan, IZU, SHIZUOKA PREFECTURE	1966	environmental-soil
NC_022874	China, Jianghan Plain, Hubei	<2013	environmental-soil
NC_022875	China, Jianghan Plain, Hubei	<2013	environmental-soil
NC_022876	China, Jianghan Plain, Hubei	<2013	environmental-soil
NC_022877	China, Jianghan Plain, Hubei	<2013	environmental-soil
NC_022879	Fukuoka, Japan	2011	environmental-animal
NC_022880	Fukuoka, Japan	2011	environmental-animal
NC_022881	Fukuoka, Japan	2011	environmental-animal
NC_022882	China, Jianghan Plain, Hubei	<2013	environmental-soil
NC_022883	Fukuoka, Japan	2011	environmental-animal
NC_022884	Fukuoka, Japan	2011	environmental-animal
NC_022885	Taiwan	2012	clinical
NC_022963	Valencia, Spain	<2013	environmental-plant and algae
NC_022992	Australia	1999/2002	veterinary
NC_022993	Lithuania	<2013	environmental-soil
NC_022994	Lithuania	<2013	environmental-soil
NC_022995	Japan	<2007	environmental-soil
NC_022996	Australia	1998	clinical
NC_023024	China	<2013	clinical potential
NC_023025	China	<2013	clinical potential
NC_023026	USA, SC	<2013	clinical
NC_023027	Dublin, Ireland	<2012	clinical
NC_023031	Beijing, China	<2013	clinical
NC_023055	Chihuahua, Mexico	<2013	environmental-plant and algae
NC_023056	Chihuahua, Mexico	<2013	environmental-plant and algae
NC_023057	Taiwan	1959	clinical
NC_023058	Zhejiang, China	2009	environmental-marine
NC_023059	Zhejiang, China	2009	environmental-marine
NC_023067	Hunan Province, China	2008	environmental-soil
NC_023068	Hunan Province, China	2008	environmental-soil
NC_023070	Zhejiang, China	2009	environmental-marine
NC_023071	Chihuahua, Mexico	<2013	environmental-plant and algae
NC_023072	Chihuahua, Mexico	<2013	environmental-plant and algae

NC_023136	USA	<2013	environmental-marine
NC_023138	Spain	<2013	environmental-animal
NC_023139	Spain	<2013	environmental-animal
NC_023140	Spain	<2013	environmental-animal
NC_023141	Spain	<2013	environmental-animal
NC_023142	Spain	<2013	environmental-animal
NC_023143	Spain	<2013	environmental-animal
NC_023144	Salem, Virginia	<2013	environmental-wastewaters
NC_023145	Salem, Virginia	<2013	environmental-wastewaters
NC_023146	USA	<2013	environmental-marine
NC_023147	Germany	<2013	veterinary
NC_023148	Spain	<2013	environmental-animal
NC_023152	Ribeira Quente, Azores	1986	environmental-marine
NC_023274	Argentina, Santa Fe, Rosario	2009	clinical
NC_023277	Czech Republic	2007/10	veterinary
NC_023278	China	2012	clinical
NC_023280	Melbourne, Australia	<2012	clinical
NC_023281	Melbourne, Australia	<2012	clinical
NC_023282	Chenzhou, China	2006	environmental-soil
NC_023283	Chenzhou, China	2006	environmental-soil
NC_023284	Chenzhou, China	2006	environmental-soil
NC_023285	Chenzhou, China	2006	environmental-soil
NC_023286	Chenzhou, China	2006	environmental-soil
NC_023287	Zhejiang, China	2009	environmental-marine
NC_023288	Zhejiang, China	2009	environmental-marine
NC_023289	Czech Republic	2007/10	environmental-animal
NC_023291	Rwandan	1994	clinical
NC_023313	Belgium	2007	clinical
NC_023314	Paris, France	2008	clinical
NC_023315	Dublin, Ireland	2011	veterinary
NC_023316	Shanghai, China	<2013	environmental-plant and algae
NC_023317	France	2010	clinical
NC_023318	France	2010	clinical
NC_023319	France	2010	clinical
NC_023320	France	2011	clinical
NC_023321	France	2010	clinical
NC_023322	Tamil Nadu, India	2005	clinical
NC_023323	China	2010	veterinary
NC_023324	China	2010	veterinary
NC_023325	China	2010	veterinary
NC_023326	China	2010	veterinary
NC_023327	China	2010	veterinary
NC_023328	China	2010	veterinary
NC_023329	United Kingdom	2009	veterinary
NC_023330	Paris, France	2008	clinical
NC_023331	China	2006	clinical
NC_023332	Korea	<2013	clinical
NC_023333	Korea	<2013	clinical
NC_023334	Korea	<2013	clinical
NC_023385	Netherlands	2009	clinical
NC_023497	East Indies	<2012	environmental-soil
NC_023898	Sydney, Australia	1997	clinical
NC_023899	Tasmania, Australia	2008	clinical
NC_023900	Tasmania, Australia	2005	clinical
NC_023901	China, Wenzhou	<2013	clinical
NC_023902	Ontario, Canada	2006	clinical
NC_023903	Greece	<2013	clinical
NC_023904	Greece	<2013	clinical
NC_023905	Greece	<2013	clinical
NC_023906	Greece	<2013	clinical
NC_023907	China	2010	clinical
NC_023909	China, Gansu Province	<2012	clinical
NC_023910	China, Gansu Province	<2012	clinical
NC_023911	China, Gansu Province	<2012	clinical
NC_023912	Spain	<2014	clinical

NC_023913	China	2009	veterinary
NC_023914	Hong Kong, China	2012	clinical
NC_023915	Montevideo, Uruguay	2009	clinical
NC_023916	Giessen, Germany	<2014	clinical
NC_023917	Osaka, Japan	<2014	clinical
NC_023918	Osaka, Japan	<2014	clinical
NC_024954	Thailand	2012	clinical
NC_024955	Anhui, China	2013	veterinary
NC_024956	Amsterdam, The Netherlands	<2014	veterinary
NC_024957	Tiszaújváros, Hungary	<2014	environmental-freshwater
NC_024958	Tiszaújváros, Hungary	<2014	environmental-freshwater
NC_024963	Netherlands	<2013	environmental-soil
NC_024964	Netherlands	<2013	environmental-soil
NC_024967	Pittsburgh, Pennsylvania	<2014	clinical
NC_024968	Sweden	<2014	environmental-human
NC_024969	Sweden	<2014	environmental-human
NC_024970	Missouri, USA	<2001	environmental-soil
NC_024972	Catamarca, Argentina	2009	environmental-estuarine
NC_024974	Switzerland	2013	environmental-animal
NC_024981	Argentina	<2013	clinical
NC_024982	Argentina	<2013	clinical
NC_024983	Malawi, Africa	<2014	clinical
NC_024986	Mexico	2013	veterinary
NC_024987	Guangzhou, China	2011	clinical
NC_024989	Japan, Miyagi	2006	clinical potential
NC_024990	Hokkaido, Japan	<2014	environmental-food
NC_024991	Hokkaido, Japan	<2014	environmental-food
NC_024992	Tromsø, Norway	2008/9	clinical
NC_024993	Hyogo, Japan	<2015	environmental-food
NC_024994	Hyogo, Japan	<2015	environmental-food
NC_024995	Hyogo, Japan	<2015	environmental-food
NC_024996	Halifax, NS, Canada	<2000	clinical
NC_024997	New York, USA	1996	clinical
NC_024998	Tokyo, Japan	<2013	environmental-plant and algae
NC_024999	Zhejiang, China	<2014	environmental-soil
NC_025000	China	<2014	clinical
NC_025002	Japan, Tochigi	2008	clinical
NC_025003	Guangzhou, China	2011	clinical
NC_025006	United Kingdom	2001	environmental-animal
NC_025009	Portugal, Lisbon	1999	clinical
NC_025011	Ljubljana, Slovenia	2000	environmental-food
NC_025012	Toyama, Japan	2003	environmental-soil
NC_025017	Bugarra, Spain	1999	environmental-animal
NC_025018	France, Mont-de-Marsan	1966	veterinary
NC_025020	Japan	2006/11	clinical
NC_025021	ND	<2000	ND
NC_025022	Lisbon, Portugal	<2012	clinical
NC_025024	Suwon, Korea	2003	environmental-plant and algae
NC_025025	China	1992	clinical
NC_025028	Gothenburg, Sweden	<2006	environmental-marine
NC_025029	Norway	1998	environmental-soil
NC_025030	USA, Yellowstone National Park	<2010	environmental
NC_025031	USA, Yellowstone National Park	<2010	environmental
NC_025032	USA, Yellowstone National Park	<2010	environmental
NC_025041	Montserrat, Caribbean	2000	environmental-freshwater
NC_025042	Clayton, Australia	<2011	veterinary
NC_025043	France	2007	clinical
NC_025044	France	2007	clinical
NC_025068	Australia	<2011	clinical
NC_025086	China	<2012	environmental-marine
NC_025096	South Korea	<2013	environmental-wastewaters
NC_025097	South Korea	<2014	environmental-wastewaters
NC_025098	South Korea	<2013	environmental-wastewaters
NC_025099	South Korea	<2013	environmental-wastewaters
NC_025104	Melbourne, Australia	2002	clinical

NC_025105	India	<2013	clinical
NC_025106	Poland,Warsaw	2011	clinical
NC_025107	Australia	2003	clinical
NC_025108	Australia	2003	clinical
NC_025109	Australia	2003	clinical
NC_025110	Sydney, Australia	2002	clinical
NC_025111	Sydney, Australia	2010	clinical
NC_025123	Belgium	<2013	veterinary
NC_025124	Belgium	<2013	veterinary
NC_025125	Belgium	<2013	veterinary
NC_025126	Belgium	<2013	veterinary
NC_025127	Japan, Kagawa	<2014	environmental-marine
NC_025128	Berlin, Germany	<2014	environmental-marine
NC_025129	Gyeongnam, Republic of Korea	<2013	environmental-food
NC_025130	Shanghai, China	2011/13	clinical
NC_025131	New Jersey, USA	2010	clinical
NC_025132	Shanghai, China	<2014	environmental-food
NC_025133	Nanjing, China	<2014	environmental-wastewaters
NC_025134	Florence, Italy	<2014	clinical
NC_025136	Beijing, China	<2014	clinical
NC_025137	Taiwan	<2014	clinical
NC_025138	Switzerland	2013	environmental-human
NC_025139	Switzerland	2013	environmental-human
NC_025140	Switzerland	2013	environmental-human
NC_025141	Switzerland	2013	environmental-human
NC_025142	Switzerland	2013	environmental-animal
NC_025143	Switzerland	2013	environmental-animal
NC_025144	Switzerland	2013	environmental-animal
NC_025145	Switzerland	2013	environmental-animal
NC_025146	Ishikawa Prefecture, Japan	1995	clinical
NC_025147	Bolivia	<2014	environmental-human
NC_025148	Latvia	1998	clinical
NC_025149	Latvia	1998	clinical
NC_025150	Latvia	1998	clinical
NC_025151	Shanghai, China	<2014	veterinary
NC_025152	Vietnam	2013	veterinary
NC_025153	Ghent, Belgium	<2013	veterinary
NC_025154	Germany	2003	environmental-food
NC_025160	Suwon, Republic of Korea	2004	environmental-food
NC_025161	Italy,Milan	<2006	environmental-human
NC_025162	Italy,Milan	<2006	environmental-human
NC_025165	Ghent, Belgium	2004	environmental-food
NC_025166	New York, USA	2010	clinical
NC_025167	New Jersey, USA	2010	clinical
NC_025168	Spain	2010	clinical
NC_025169	Taipei, Taiwan	<2012	clinical
NC_025170	Taipei, Taiwan	<2012	clinical
NC_025171	Taipei, Taiwan	<2012	clinical
NC_025172	Taipei, Taiwan	<2012	clinical
NC_025173	Taiwan	<2014	clinical
NC_025175	Switzerland	2013	environmental-human
NC_025176	Switzerland	2013	environmental-human
NC_025177	Switzerland	2013	environmental-human
NC_025178	Switzerland	2013	environmental-human
NC_025179	Switzerland	2013	environmental-animal
NC_025180	Switzerland	2013	environmental-animal
NC_025182	Nigeria	2009	clinical
NC_025183	Beijing, China	<2013	clinical
NC_025184	Shanghai, China	2011/13	clinical
NC_025185	USA	<2014	clinical
NC_025186	Switzerland	2012	environmental-freshwater
NC_025187	New Jersey, USA	2009	clinical
NC_025189	Maharashtra, India	1992	environmental-plant and algae
NC_025190	Latvia	1998	clinical
NC_025191	Australia	2012	clinical

NC_025192	Germany	2000	clinical
NC_025193	Japan	<2013	environmental-plant and algae
NC_025194	Germany	2002	clinical potential
NC_025195	Australia	1987	clinical
NC_025196	Germany	2003	environmental-food
NC_025197	China	<2014	clinical
NC_025198	Australia,Sydney	<2014	clinical
NC_032098	Brazil	<2016	clinical
NC_032099	ND	<2016	clinical
NC_032100	Denmark	<2014	ND
NC_032101	Kentucky, USA	2015	clinical
NC_032102	Kentucky, USA	2015	clinical
NC_032103	China	2015	clinical